JOURNAL OF THE AERONAUTICAL SCIENCES

AERONAUTICAL REVIEW SECTION

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JOURNAL OF THE AERONAUTICAL SCIENCES

AERONAUTICAL REVIEW SECTION

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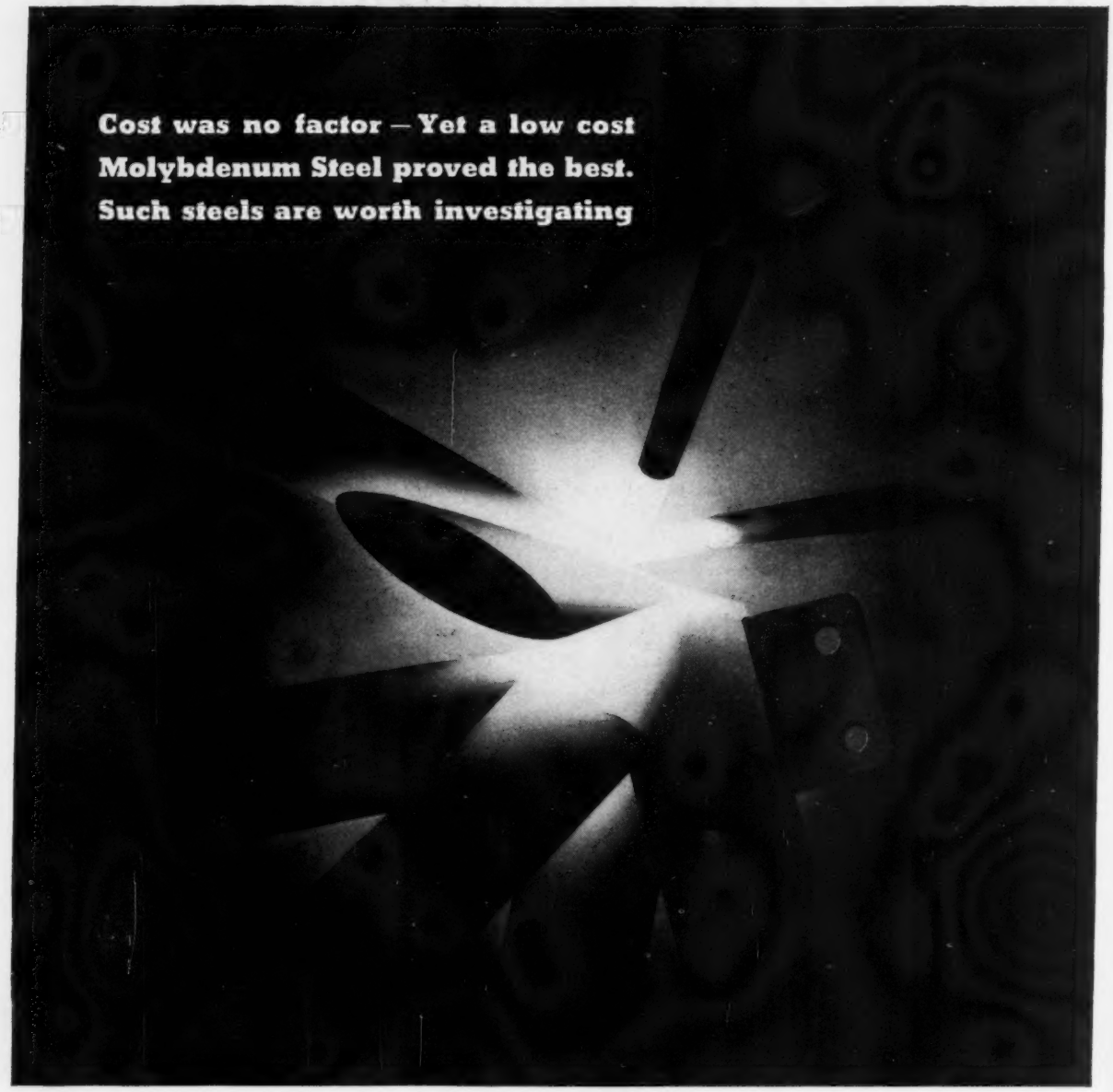

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THE AMERICAN'S CREED

A Summary of American Civic Faith

by William Tyler Page

I believe in the United States of America as a government of the people, by the people, for the people; whose just powers are derived from the consent of the governed; a democracy in a Republic; a sovereign Nation of many sovereign States; a perfect Union, one and inseparable; established upon those principles of freedom, equality, justice, and humanity for which American patriots sacrificed their lives and fortunes.

I therefore believe it is my duty to my Country to love it; to support its Constitution; to obey its laws; to respect its flag; and to defend it against all enemies.

THE B. G. CORPORATION . . . . . 136 WEST 52nd STREET . . . . . NEW YORK, N. Y.

A copy of The American's Creed and The Story of The American's Creed, (see overleaf) suitable for framing, will be sent upon request.

The STORY of THE AMERICAN'S CREED

THE idea of laying special emphasis upon the duties and obligations of citizenship in the form of a national creed originated with Henry S. Chapin. In 1916-17 a contest, open to all Americans, was inaugurated in the press throughout the country to secure "the best summary of the political faith of America." The contest was informally approved by the President of the United States. Through Mayor James H. Preston, the city of Baltimore, as the birthplace of the Star-Spangled Banner, offered a prize of $1,000, which was accepted, and the following committees were appointed: A committee on manuscripts, consisting of Porter Emerson Browne and representatives from leading American magazines, with headquarters in New York City; a committee on award, consisting of Matthew P. Andrews, Irvin S. Cobb, Hamlin Garland, Ellen Glasgow, Julian Street, Booth Tarkington, and Charles Hanson Towne; and an advisory committee, consisting of Dr. P. P. Claxton, United States Commissioner of Education, governors of States, United States Senators, and other National and State officials.

The winner of the contest and the author of the creed selected proved to be William Tyler Page, of Friendship Heights, Md., a descendant of President Tyler and also of Carter Braxton, one of the signers of the Declaration of Independence.

From the CONGRESSIONAL RECORD

The complete proceedings in regard to the official acceptance of The American's Creed may be found in the Congressional Record, No. 102, April 13, 1918, from which is taken the following explanation of the doctrinal origin of the creed:

"The United States of America."—*Preamble, Constitution of the United States.*

"A government of the people, by the people, for the people."—*Preamble, Constitution of the United States; Daniel Webster's speech in the Senate, January 26, 1830; Abraham Lincoln's Gettysburg speech.*

"Whose just powers are derived from the consent of the governed."—*Thomas Jefferson, in Declaration of Independence.*

"A democracy in a republic."—*James Madison, in The Federalist, No. 10; Article X of the amendments to Constitution.*

"A sovereign Nation of many sovereign States."—*"E pluribus unum," great seal of the United States; Article IV of the Constitution.*

"A perfect Union."—*Preamble to the Constitution.*

"One and inseparable."—*Webster's speech in the Senate, January 26, 1830.*

"Established upon those principles of freedom, equality, justice, and humanity for which American patriots sacrificed their lives and fortunes."—*Declaration of Independence.*

"I therefore believe it is my duty to my country to love it."—*In substance from Edward Everett Hale's The Man Without a Country.*

"To support its Constitution."—*Oath of allegiance, section 1757, Revised Statutes of the United States.*

"To obey its laws."—*Washington's Farewell Address; Article VI, Constitution of the United States.*

"To respect its flag."—*National anthem, The Star-Spangled Banner; Army and Navy Regulations; War Department circular on flag etiquette, April 14, 1917.*

"And to defend it against all enemies."—*Oath of allegiance, section 1757, Revised Statutes of the United States.*

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The Bibliographic Approach

PRESENT PLANS FOR THE expansion of aircraft production call for spreading even more thinly the engineering, supervision and management services of experienced executive personnel. As time is at a premium, it becomes increasingly important that the most effective use be made of their time, and that duplication of effort in research, development, and the improvement of manufacturing methods be held to a minimum. It is the reason for their interest in current activity. It is the reason for their extensive use of special bibliographies such as those published in the Aeronautical Review.

Today, these men face another problem; one of multiplying themselves professionally. Expanded production plus the speed-up in research and development has necessitated the education and training of more research and production engineers, more executive engineering manpower to re-enforce the thin line of veteran talent.

Much of the necessary subject matter is undergoing rapid growth and development. It has not yet been digested and assembled for the normal processes of education. Standard works and texts supply the background and development up to the time of writing. Usually, however, there remain two fields of supplementary reading and study. One supplements the text itself and is usually recommended by the author. The other bridges the gap between publication of the work and the present. Both are usually to be found in special bibliographies.

For example, the subject of Alloy Steels is typical of many in modern aircraft production. According to the editor of *Modern Steels*, a volume of lectures published by the American Society for Metals, "There has not yet been published any consistent account of the properties of alloy steels, probably because of the rapid growth of the subject. Cognizance of this fact is taken by adding to each lecture bibliographic comment and recommendation by the editor, of lectures, papers, and books dealing with subjects under discussion. Thus the student is encouraged to employ the "bibliographic approach" to subjects in the state of rapid development.

Many subjects in modern aviation are in a similar fluid state of growth so rapid that the use of special bibliographies and study of current literature offer the most effective research and educational media. To the engineer, the up-to-date bibliography is a technical assistant and guide, ready with information about the past and present, and a ready source of ideas for the future. Instead of turning to a man, one turns to a book or journal and thence to a "conference" with experts through the media of their writings and printed lectures.

News and History

The length of a newspaper article or the prominence of its position is not always an accurate indication of its value to current history. The news story which occupied the right hand column of page one, in the morning, may be replaced by the record of some more important, more colorful or more timely event by the time the evening papers go to press.

Like tiny cracks in the ice, which are sometimes the first signs of a coming avalanche, important news events frequently make their first appearance as seemingly insignificant items in the inside pages of newspapers. For this reason, they often go unnoticed. A lag in airplane production is news. Causes, first recorded in small items such as the lack of trained machinists, the difficulty in the procurement of machine tools, threatened material shortages, were not news. These items appeared months ago but went unnoticed for the most part, except by trained observers.

The purpose of the News Review is to record chronologically aviation history as it is reflected not only in the major news stories but in the smaller items which may become especially significant to the future of the aviation industry. Articles on the same event, appearing in several newspapers, are read and their contents compared. Different observers and organizations frequently vary in their reporting and interpretation of the same happening.

The leveling effect of this treatment of news items is surprising. Daily newspapers are edited, naturally, for the average reader. Many events which are of real significance to the aviation industry are of small interest to the general newspaper reader and are often relegated to inside pages. The News Review, therefore, selects for its readers the aviation news from all other reading matter carried in the daily press, and measures it against the standard of its importance as aviation history.

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of the

Institute of the Aeronautical Sciences

A new lending library service of the Institute which makes available, without charge, the latest and more important aeronautical books to members of the Institute and others interested in aeronautical progress.

Membership in the library is open to all members of the Institute of the Aeronautical Sciences and to any person in the United States over 18 years of age who can furnish references which certify as to his responsibility and reliability.

The Aeronautical Reader's Guide

A catalogue of selected aeronautical books available for loan from The Paul Kollsman Library. The Guide lists and comments on books and by indexing them under specialized headings also acts as a valuable reference source for aeronautical specialists, companies, libraries and other organizations.

The Guide is issued quarterly in September, December, March and June, and is priced at $1 for the four issues in each volume. Single copies are not available and subscriptions may only be accepted for complete volumes.

Further information will be sent on request.

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A Monograph on the Theory of Elasticity

The appearance of another Engineering Monograph by America's foremost elastician, Professor Stephen Timoshenko, of Stanford University, deserves special notice. The text is a distinct contribution to our literature on the theory of elasticity, and fills another gap in the Timoshenko "bookshelf" of the world's best literature on theoretical and applied mechanics.

The book is written principally for engineers engaged in the design of thin walled structures such as is found in ship hulls, airplane structures, boilers and structures of thin flat slabs and plates.

A preliminary knowledge of mathematics, statics and strength of materials as usually taught in schools of engineering is assumed. The additional mathematics necessary for the subject, which is considerable, is presented in the usual clear manner characteristic of Professor Timoshenko's works.

Specifically the Monograph deals with the general theory of bending of plates under lateral loads, with applications to circular and rectangular plates and with numerous tables simplifying the calculations of deflections and stresses in plates; the combined bending and tension or compression of plates with applications to thin plates; and the bending of shells with applications to cylindrical and spherical shells.

The following table of contents by chapters is the best outline of its value to designers and teachers:

(1) Bending of Long Rectangular Plates to a Cylindrical Surface. (2) Pure Bending of Plates. (3) Symmetrical Bending of Circular Plates. (4) Small Deflections of Laterally Loaded Plates. (5) Simply Supported Rectangular Plates. (6) Rectangular Plates with Various Edge Conditions. (7) Plates of Various Shapes. (8) Bending of Plates Under the Combined Action of Lateral Loads and Forces in the Middle Plane of the Plate. (9) Large Deflections of Plates. (10) Deformation of Shells Without Bending. (11) General Theory of Cylindrical Shells. (12) Shells Having the Form of a Surface of Revolution and Loaded Symmetrically with Respect to Their Axis.

The book contains a great deal of new material brought together from scattered sources and presented in a logically arranged sequence. Many of these sources are his own works published in Russia and elsewhere.

The monograph will be very valuable as a reference or text for graduate courses in the mathematical theory of elasticity and in the stress analysis department of every aircraft factory.

JOHN E. YOUNGER
University of Maryland

Theory of Plates and Shells, by S. Timoshenko; an Engineering Societies Monograph, McGraw-Hill Book Company, Inc., New York and London, 1940; 482 pages, $6.00.

Books reviewed in this section may be purchased, or borrowed without charge, from The Paul Kollsman Library, Institute of the Aeronautical Sciences, 1505 RCA Building West, Rockefeller Center, New York, N. Y.

Aerial Photography Introduced to the Surveyor

There has been a steady and important growth in the use of aerial photography for many purposes, including not only military, mining, and flood control purposes, but also in the general field of surveying. This growth has resulted from (1) the publicity given to the subject during the war of 1914–18, (2) the natural enthusiasm of those who devised improvements in methods and machines for taking and interpreting photographs made from the air, and (3) the accuracy of the results obtained and their economy when undertaken on a large scale.

Many persons in various fields of engineering have investigated the employment of these methods to meet their particular needs. To aid such inquirers, an English authority has published a new book, "Air Photography Applied to Surveying," which is designed to provide information that will aid prospective users of the method. It will also be helpful to students, serving as a general introduction to the subject, and suggesting directions of further study.

In considering the possible applications of an air survey, it is important to have some knowledge of the scope and limitations of the process, so that its possibilities may be evaluated, and also to enable the aerial photographer and his clients to deal on a common basis of understanding. The book provides this necessary information. To some, aerial photography may appear forbidding, due to the amount and cost of apparatus required, both on the ground and in the air. Moreover, it is not particularly encouraging to those who think that an aerial survey will do everything, to read the author's statement that "air photography provides another method of surveying that is additional to and *not* a substitute for existing methods." Nevertheless, the book cannot be put down without acquiring an understanding not only of the problems, but of the definite and often invaluable contributions to surveying.

Both history and practice are included, and there is a short tabulation of estimated costs of aerial photography, per square mile, in shillings. There is a brief description of the instruments used. Considerable emphasis is laid upon the value of stereoscopy, and reproductions for two-color overlapping stereos are included, with spectacles for viewing them. Elementary perspective also is briefly treated.

Air Photography Applied to Surveying, by C. A. Hart; Longmans, Green and Co., New York, 1940; 366 pages, $7.50.

Spies Seek Super-Plane

George Gibbs, who has written many adventure books with historical and factual backgrounds, adds "The Silver Death" to his long list of aviation fiction. The airplane from which the book takes its title is supposed to give Germany mastery of the air. The adventures of secret service men of two countries who seek to "appropriate" the craft provide thrills, suspense, and action for a winter evening.

The Silver Death, by George Gibbs; D. Appleton-Century Co., New York, 1939; 270 pages, $2.00.

Introduction to the Study of Steels

The Pittsburgh Chapter of the American Society for Metals some time ago presented a series of thirteen lectures on the general topic of "Modern Steels." Under this title the lectures and their illustrations have been gathered together into book form.

The book tacitly recognizes its introductory nature by including, at the end of each lecture, a brief bibliography and suggestions for study. In addition it presents review questions. General subjects treated include the production of pig iron, steel making and pouring, hot working, inspection and testing, metallography, heat treatment, alloy, stainless and tool steels. The metallographic lectures are especially interesting and are illustrated by numerous photographs showing the microstructure of various steels. In one of the two lectures on heat treatment there are twelve unusual photographs, evidently made through a glass tank, showing different phases of quenching in water, oil, and brine or caustic.

Modern Steels, edited by Ernest E. Thum; American Society for Metals, Cleveland, Ohio, 1939; 374 pages, $3.50.

How to Behave in an Air Raid

The protection of civilians during attacks from the air during a modern war depends largely on the precautionary measures taken before the raiders arrive. The manner in which air raid shelters have been constructed, the effectiveness with which the warning system gets non-combatants to shelter, the speed with which fire fighting units can minimize the effect of the raiders bombing and the thoroughness with which the wreckage is cleared may be major factors in a war.

The author, a Swiss born American citizen, toured Europe just before the outbreak of hostilities in the present war. He witnessed the Czech crisis and had an opportunity to study, first hand, the air raid precaution systems in England, France, Switzerland and Germany. From his observations abroad and from the pamphlets published by the various governments, he created a manual for civilian defense against attack from the air. It describes the organization and training of Air Raid Precaution personnel, the construction and maintenance of air raid shelters and rules for behavior during an air raid.

Civil Defense Manual for Peace and War Emergencies, by H. Mayer-Daxlanden; Savoy Book Publishers, Inc., New York, 1940; 45 pages, $0.50.

Youngstown Sheet and Tube Co.

A finished steel strip on the run-out tables. An illustration from *Modern Steels* by Ernest E. Thum.

Current Testing of Materials

During the 42nd Annual Meeting of the American Society for Testing Materials a number of technical papers and committee reports were presented on various subjects directly or indirectly concerned with aviation and related industries. They are to be found in the Proceedings of the meeting, now available in a 1344-page book.

The volume is well organized, permitting quick reference to any subject. Committee reports are classified under the headings of ferrous and non-ferrous metals, masonry materials, miscellaneous materials (which includes paints and fuels) and miscellaneous subjects, chiefly test methods. Technical papers are classified under much the same heads.

Many of the reports and papers on metals will naturally be of interest in aviation. Reports on such subjects as gum in gasoline, tetraethyl lead, a proposed method of test for neutralization number of used aviation oils, and proposed specifications for aviation gasoline are reproduced.

Among the technical papers are the following: "Correlation of Some Mechanical Tests of Aluminum Alloys with X-Ray Tests," by Tom A. Triplett and W. Lavern Howland; "Some Mechanical Tests on Aluminum Alloys 14S-T and 24S-T," by W. B. Mechling and S. S. Jack, who did part of their work in the research laboratories of the Douglas Aircraft Company.

Proceedings of the 42nd Annual Meeting (June 26–30, 1940) of the American Society for Testing Materials; Vol. 39, Committee Reports and Technical Papers; American Society for Testing Materials, Philadelphia, 1940; 1344 pages, $9.00.

War on the Wing

Non-military men who listen to arguments about military aviation have been heard to ask this innocent question: "Well, what is aviation supposed to do for the army today?" An excellent way of answering this question is to refer the inquirer to Chapter 13 of a new book by Lowell M. Limpus. This chapter describes in thirteen pages how observation airplanes, fighters, and bombers play their parts in warfare under the present U.S. Army organization scheme. Only the briefest mention is made of the fact that other systems are being considered. The author refuses to take a partisan position and contents himself with outlining the present principles of air command.

In other chapters similar information is given about infantry, artillery, cavalry, mechanized units, and so on. Some space is devoted to a non-technical exposition of the principles of tactics, organization, discipline, logistics, and the laws of war. The book is a popularization of the problems being studied by Army officers today.

Twentieth Century Warfare, by Captain Lowell M. Limpus, U.S. Army Reserve; E. P. Dutton & Co., New York, 1940; 205 pages, $1.75.

Military Aviation Seen through the Eyes of an Army Pilot

During the Spanish civil war James L. H. Peck flew for the Loyalists, thereby obtaining a perspective of aerial warfare that is reflected in his new book, "Armies With Wings." It is granted that in the comparatively short time that has elapsed since then, there have been many improvements in airplanes and changes in methods of defense against them, particularly in anti-aircraft artillery. Nevertheless, the author's descriptions of some of his air battles and experiences in Spain give a convincing personal touch to a book that explains military aviation in terms that the non-military and non-technical reader can understand.

The different missions entrusted to airplanes are defined, with details of the machines themselves. Research, design and manufacture are discussed, and much is said about the human element —the selection and training of pilots, their limitations, and the effects of high-speed maneuvers upon the body.

It is suggested that the educational requirements for student pilots might possibly be lowered in some respects in order to avoid excluding men who are well fitted in many ways but lack the required educational training. Today's aerial strategy is described and the reasons for and the difficulties of formation flying explained. The book concludes with a report of the flight tests made by the author in a new plane, including the final 21,000 ft. power dive.

Armies With Wings, by James L. H. Peck; Dodd, Mead & Co., New York, 1940; 274 pages, $2.50.

Manual Aids Maintenance and Operation of the Link Trainer

The number of Link Trainers in use is increasing so steadily that the appearance of a book detailing their construction, maintenance and operation will be welcomed by many schools. The book, entitled simply "The Link Trainer," is in effect a manual of installation, maintenance, service and repair, with a summary of a training program to be followed by the instructor.

The various parts of the device and their functions are thoroughly illustrated and described, with diagrams and perspective drawings. Wiring diagrams are included for the electrical apparatus as well. Thus if necessary, repairs on any unit can be carried out quickly and easily by any competent radio man and mechanic.

A separate section is devoted to the maintenance and repair of the Kollsman Telegon Instruments that are a part of Link Trainer equipment. Type I. D. (Canadian) and Type D (American) Trainers are included in the book, which is authoritative, since much of the information in it was provided by the manufacturers of the Link Trainer and the Kollsman Instrument Division of the Square D Company.

The Link Trainer, E. Molloy and E. W. Knott, Editors; Reginal Saunders, Toronto, 1940; 132 pages, $2.00.

Instruction in the "Universal Language" of Industry

Due to the current demand for skilled draftsmen, thousands of young men today are taking drafting courses to fit them for positions in the aircraft, armament and allied industries. Many of them no doubt are using the new book, "Technical Drafting." It is designed particularly for use in schools and each chapter contains numerous problems which can be assigned to groups or individual students for solution. However, it is also valuable to the experienced draftsman who wishes to review modern work on current drafting practice.

Some of the problems relate to aircraft, but the book as a whole endeavors to survey the entire drafting field. It includes all the major divisions of industry and engineering. An especially useful chapter studies welding from the draftsman's viewpoint. Inasmuch as there is a steady increase in the use of gas and electric processes, this material should be of considerable value to the student and the man at the factory drafting board. Chemical, electrical mechanical, civil and mining, industrial and architectural drafting are other subjects discussed. There are of course many pages devoted to the fundamentals of drafting processes and theories to aid the beginner.

This presentation of the basic concepts of drafting utilizes new and old methods, the newer method omitting the customary consideration of planes of projection when demonstrating the theory upon which engineering drawings are based. A separate chapter provides an explanation of the older and more conservative development of drawings, and may be used if desired. The author is frank in stating his preference for the newer plan of instruction.

The book is well illustrated. Many of the drawings employed, particularly in the problems, have been taken directly from the files of prominent companies in various industries. "Graphics is the universal language of the industrial world," states the author, and this is an excellent way of learning that language.

Technical Drafting, by Charles H. Schumann; C. E. Harper & Brothers Publishers, New York, 1940; 793 pages, $3.50.

A Woman's Story of a World Flight

Some time ago Marjorie Shuler, a writer and reporter, was sent off on a trip around the world, to be made entirely on commercial airlines. Just when this took place is difficult to discover. Her book describing the trip lacks the dates, flying hours and similar details that would have been even more interesting to the future air historian than her very readable impressions of everything else are to the reader of today.

However, if her story does not rank as history it is certainly interesting, and good promotional material for air travel. She had a good time, and through her woman's eyes saw many things about commercial airplanes, airports and foreign places that might have escaped a more technical observer. Tourist agencies may well pigeonhole the book against the day when such flights become possible once more.

A Passenger to Adventure, by Marjorie Shuler; D. Appleton-Century Co., New York, 1939; 261 pages, $3.00.

An Aviator Looks at Man, and Writes a Classic

Some years ago a movement grew to take those little gold propellers and wings off coat lapels, to keep the tales of almost-unhappy landings for the non-public meetings sometimes known as "hangar flying," to make of the pilot an ordinary mortal and to change flying from adventure to transportation.

Yet it has not hampered the expression of aviators who have something to say, and more important, know how to say it, as is shown by any number of books. Among them, "Wind, Sand and Stars" stands out. There are perils in it, experiences in the air over the Sahara, the seas, the Andes, and battles with hostile elements. Yet for all its narrow escapes it is not a book of adventures. Nor is its chief interest in flying, as such. To the French airman who wrote this book, aviation is the backdrop on which he paints the setting for Man; man the animal and man the philosopher, the destroyer but the creator, victim but victor, slave but master.

There is great nobility to this work, and tremendous beauty. Let it be listed as a book to be read and owned with pride, not because it is about pilots, but because it is about men.

Wind, Sand and Stars, by Antoine de Saint Exupéry; translated from the French by Lewis Galantière; Reynal and Hitchcock, New York, 1940; 306 pages, $2.50.

Petroleum Processes Outlined

Those in the Aeronautical profession engaged in engine design and maintenance will find useful information in "Petroleum Refining and Manufacturing Processes." This book presents elementary information about manufacturing methods and the resulting products. For example, if a man wonders what goes on in a battery of stills, what the cracking process is, what happens in a bubble tower and what makes a "doctor test" sweet or sour, here he can find out. Chemical formulae are seldom used, and the few that appear are simple.

Due to the use of refining terminology, the volume will be of limited value to anyone who does not have at least a speaking acquaintance with the business. It is not intended for the student, but for the practical man. The method is to describe in general terms the manufacture of the various products, and state their characteristics and uses. There are numerous specifications, including those for aviation gasoline and other petroleum products used in aviation. Occasionally the author takes the liberty of criticizing a specification. For instance, he states that color in gasoline is not necessarily an indication of injurious impurities, while the processes required to correct color may lower some of the fuel's desirable qualities. The book concludes with tables of useful data.

Petroleum Refining and Manufacturing Processes, by Maxcine J. Japour; Wetzel Publishing Inc., Los Angeles, Calif., 1940; 310 pages, $5.00.

An Aviation Yearbook

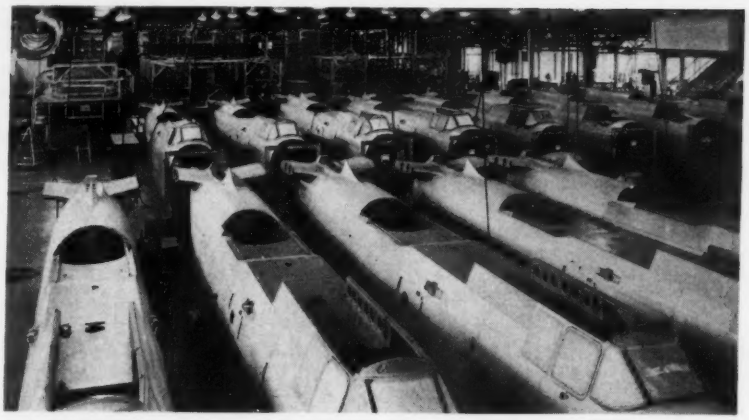
To design the contents of any book which is primarily intended to arouse the interest of young people but is as informative to persons of any age, could only have been done by experienced writers. Two aviation editors of the *New York Times*, men whose recording of current aeronautics have gained for them an enviable reputation for accuracy and dependability, have presented the story of aviation in the modern manner. Half the book consists of action photographs while the other half is informative text.

The scope of the book includes all the branches of aviation which are of general interest. Brief, clear comment introduces the illustrations which follow in each chapter. The caption describing each picture tells just what anyone would wish to know about it and also continues with supplementary information which gives the reader many additional facts to round out the text.

The book opens with a comprehensive discussion of the latest aeronautical research. The manufacture of aircraft is described and the reader sees how a plane is built and how an airplane engine takes form. Then follows a dramatic picture of the different kinds of commercial aviation, from transpacific Clippers to crop-spraying by plane. One of the most fascinating sections of the entire book is the description of America's great airports and of countless instruments and navigational aids which they use. Every aspect of military aviation is included: trainers, pursuit ships, attack airplanes, dive-bombers and other sky fighters are described and pictured, together with a detailed description of both ground and flying personnel. Private flying, gliding and other specialized branches of aviation precede a description of air and ground schools, flying fields, etc.

As a gift book it serves a useful purpose in dramatizing for young people the scope and range of the modern wings of today. This issue is more than a survey of the accomplishments of aviation for a year. It is to be hoped that the authors and publisher will find that such a purposeful annual meets a need which will cause them to add a new volume each year.

Young America's Aviation Annual, by Frederick P. Graham and Reginald M. Cleveland; Robert M. McBride & Company, New York, 1940; 270 pages, $2.00.



Jigs and fuselages of the Douglas DB-7, shown at the El Segundo Division of the Douglas Aircraft Company. From *Young America's Aviation Annual*, by Frederick P. Graham and Reginald M. Cleveland.

Guide for Stamp Collectors

Many people connected with aviation have made the collection of air mail stamps a hobby. "Philately," by L. N. and M. Williams, will interest them as they expand their collections. Only two pages are given to air mail, the book being chiefly concerned with history and such technical details as gum, watermarks, printing, perforations and similar fine points of interest to the philatelist. Individual stamps illustrated and described are chiefly those of England and her colonies but there is a short paragraph about some unusual American stamps.

Philately, by L. N. and M. Williams; Pitman Publishing Corp., New York, 1939; 158 pages, $1.75.

How to Service Shock Absorbers, Wheels and Brakes

The third volume in the Aeroplane Operation and Maintenance Series is an excellent collection of information on construction and servicing procedures of undercarriage units. Commercial makes treated in the volume are: Lockheed, Vickers, Turner, Dowty, Bendix, Dunlop and Palmer. In addition, details are given of the legs of the Percival Vega Gull and the D. H. Moth Minor.

The section dealing with the Lockheed Airdraulic is exceptionally complete, including not only detailed instructions but many excellent photographs illustrating servicing methods. The same plan is followed for other main types of devices. Fewer details are necessary for individual mechanisms falling within the classifications previously described.

Having been prepared in England for English ground crews, the book naturally gives much of its space to English equipment. However, it should be of interest in this country, especially for the excellent Lockheed and Bendix sections.

Landing Legs, Wheels, and Brakes, edited by E. Molloy and E. W. Knott; Chemical Publishing Co., New York, 1940. 132 pages, $2.00.

Second Edition of Textbook on Strength of Materials

Timoshenko's two-volume work on "Strength of Materials" is well known to engineers, to whom it presents both elementary and advanced aspects of the subject. As a result of experience with it, the author, five years ago, published an abridgement in a single volume, designed specifically for the use of students in engineering courses. This, entitled "Elements of Strength of Materials," has now appeared in a second edition.

Some of the revisions include an increase in the number of problems, redrawing of numerous illustrations, and changes in notation to bring it nearer the American Standards Association list. New material has been added, including an article on welded joints, a chapter containing a brief outline of photoelastic methods, and expansion of the treatment of topics such as moving loads, creep of metals at elevated temperatures, and fatigue. In its revised form the book should be of increased value to the student. It can also be used as a "refresher" for the graduate. There are no direct references to aviation, but the basic formulas for shear, stress, torsion and strain are of course the concern of every designer.

Elements of Strength of Materials, Second Edition, by S. Timoshenko and Gleason H. MacCullough; D. Van Nostrand Co., New York, 1940; 365 pages, $3.25.

Exposition of Simpler Method of Deriving Maps from Aerial Photographs

Photogrammetry, or the science of producing maps from aerial photographs, has come to be considered an extremely complicated process, due to the customary method of working the problem in three dimensions, treating tilt and relief simultaneously. This requires expertness in calculus and solid geometry. There is, however, a simpler method, explained in "Applied Photogrammetry," which handles tilt and relief separately and requires no mathematical knowledge beyond plane geometry and trigonometry. The system permits the work to be done graphically on the back of the photographs with ordinary drafting instruments.

In the second edition of his book explaining this method, R. O. Anderson has expanded the theory considerably, at the same time preserving a practical treatment for the benefit of the engineer faced with specific problems. In addition, frequent numerical examples are provided so that the student or novice can employ the work to increase his knowledge of the subject and acquire skill in handling it.

The latter part of the book describes the analytical-ray method of control for the computation of the geodetic positions of definable images, in order to reduce ground surveys to a minimum.

However, when the Dropped Perpendicular Method is employed as described in the book failure results when, as occasionally happens, the scale points fall in a straight line. To cover such a case, and also instances of excessive tilt and relief, other procedures are necessary, as described in a separate pamphlet which supplements the main volume.

Applied Photogrammetry, Second Edition, 1939; 191 pages, $2.50, and **Tilt of the Aerial Photograph by Graphical Resection,** 1940; 50 pages, $1.00; by Ralph O. Anderson; Edwards Brothers, Ann Arbor.

Modern Warfare Analyzed by a Newspaperman

There is a new war book, entitled "Blitzkrieg," whose vigor of expression and definiteness of view probably will not only interest and hold the reader, but bring up more ammunition into the battle now waging over the precise nature, technique and value of mechanized warfare, particularly in the air. The author holds that war as now practiced by the German Army is new in some of its elements and tactics, but old as time in the sense that its fundamental purpose is to put the infantry in possession of enemy territory.

Obviously, the new elements are tanks, trucks, and the airplane, which are not properly weapons at all except in so far as tanks and airplanes act as artillery. The new tactics consist, first, of disregarding enemy strongholds, and attacking the rear—headquarters, communications, supplies and civilians. This method, as the book admits, is not in itself new, having been employed in ancient times, but seems radical to those who think the war of 1914–18 set a permanent pattern. The second new tactic, if it can be so called, is a perfection of staff control to such a point that every military arm and service is coordinated and welded together into a unity of command and action such as probably has not been seen since the days when a commander could stand on a hill and watch the entire battle.

According to this view the airplane is not and should not be in any sense independent, but should perform its triple functions of reconnaissance, attack, and troop transport "in a perfect marriage of land power and air power."

A large part of the book contains criticisms of British failure to see the perils ahead, to perceive the change in warfare, and to take appropriate action. England's reliance upon her navy is held to be defensive and largely mistaken, chiefly on the ground that only the infantry can win a war, which is the official dogma of the U.S. Army, as expressed in paragraph 123, Field Service Regulations.

S. L. A. Marshall, the author of this book, is a newspaperman, a veteran of the World War, and a student of military matters. He writes with all the energy, conciseness and clarity of the best journalism, and at times with the vehemence of an aroused and "fighting" editor.

Blitzkrieg, by S. L. A. Marshall; William Morrow & Co., New York, 1940; 188 pages, $2.00.

Engine Instruction in Compact, Easily Understood Form

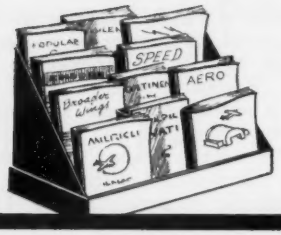
Text No. 3 of Frederick B. Thompson's "Transport License Method" is devoted entirely to engines and their parts and accessories, and is a good presentation of both theory and practice. The theoretical discussions, however, omit mathematics except for simple equations when discussing power, every attempt being made to impart a wide variety of information in easily understood and practical terms.

It is not too much to say that the reader will find here the gist of a number of specialized technical books, and that even those who have studied engines from the engineering viewpoint may find it useful in pointing up their knowledge and keying it to the conditions under which engines must be operated, serviced and overhauled.

The first chapter considers general principles of engine design and operation as reflected in aircraft engines, with explanations of differences between aviation and automobile engines where they exist, as in clearances. Other chapters discuss specific parts and devices. Chapter 4 provides the basis for a good understanding of such matters as volumetric efficiency, supercharging, brake and dynamometer tests, propellers, economy and performance under different conditions.

After each chapter there is a list of review questions. There is also a glossary, and a list of some available engine service manuals, with prices. The book is suitable not only for use in schools, but for home study.

A Practical Aircraft Engine Study, by Frederick B. Thompson; Text 3 of The Transport License Method; Thompson Aviation Publishers, Detroit, 1940; 130 pages, $3.00.



Periodicals

The reviews in these pages reflect the statements and opinions of the authors of the articles reviewed, and are not to be taken as editorial expressions of the Aeronautical Review.

Aerodynamics

Theory of Laminar Boundary Layer. K. Wada. The writer presents a theory of laminar boundary layer giving the solution, which satisfies the differential equation of boundary layer in simplified form for practical engineers. For that purpose it is necessary to make certain assumptions as to the pattern of fluid motion within a boundary layer. The solution is compared with results of known experiment, so that the theory and assumptions as a whole may be justified. *Report of the Aeronautical Research Institute, Tokyo Imperial University*, September 1940, No. 196 (English translation).

On the Permissible Roughness in the Laminar Boundary Layer. Itiro Tani, Ryosuke Hama and Satosi Mituisi. A report on a series of wind tunnel tests conducted to determine the height to which extrusions can extend above a flat surface or above the surface of an airfoil without disturbing the boundary layer and causing turbulence behind the extrusions. *Report of the Aeronautical Research Institute, Tokyo Imperial University*, October 1940, 11 pages, 5 illus.

Contributions to the Design of Aerofoils Suitable for High Speeds. Itiro Tani and Satosi Mituisi. Presentation of three factors in the design of high-speed airfoils. These include (1) a theoretical calculation to determine the shape of a center line that gives a uniform distribution of pressure when the thickness of the center section is lessened, (2) a theoretical calculation to determine the shape of a symmetrical section with uniform distribution of pressure, (3) a symmetrical section is designed and tested in a small wind tunnel to obtain experimental evidence. *Report of the Aeronautical Research Institute, Tokyo Imperial University*, September 1940, No. 198 (English translation).

On the Subsonic Flow of a Compressible Fluid Past an Elliptic Cylinder. Isao Imai and Takasi Aihara. In this paper a new method of treating the two-dimensional subsonic irrotational flow of compressible fluids is given, which consists essentially of making use of conjugate complex variables. In illustration of the method, the flow past an elliptic cylinder in an arbitrary orientation with any circulation is considered, and the expression for the velocity potential correct to the order of M^2 is obtained without recourse to any infinite series expansions. An explicit formula is also given for the velocity distribution on the surface of an elliptic cylinder in the absence of circulation. In addition, the critical Mach numbers for the flow past elliptic cylinders with their major axes perpendicular to the undisturbed flow are calculated for a series of values of their fineness ratios. *Report of the Aeronautical Research Institute, Tokyo Imperial University*, August 1940, No. 194 (English translation).

A Simple Method of Calculating the Aerodynamic Characteristics of a Monoplane Wing. Itiro Tani. First a method is shown for calculating the spanwise lift distribution and other aerodynamic characteristics of a simple wing. Effects of landing flap displacement and aileron displacement are considered, the calculation being simplified by considering effects on a reference wing of elliptic planform, and modifying results in proportion. Numerical examples are added in order to explain the application of the method and to check its accuracy. Lateral stability derivatives are calculated in the same manner. In addition, to provide data for a number of aerodynamic characteristics, a series of straight tapered wings is calculated by the method discussed. *Report of the Aeronautical Research Institute, Tokyo Imperial University*, September 1940, No. 197 (English translation).

The Fixed Leading Edge Slot and Aileron Control, Part 2. Alexander Klemin. Part 1 of this article reported the results of tests on three fixed leading edge slots and ailerons in application to the N.A.C.A. 23012 airfoil in rectangular planform. Part 2 gives corresponding data on a tapered airfoil. This includes the effect of leading edge slots on force characteristics, on rolling moment coefficients, on yawing moment coefficients, and general conclusions. *Aero Digest*, December 1940, pages 102, 105, 197, 8 illus.

Rechnerische Bestimmung des Neutral punktes von Fluegeln (Mathematical Determination of the Neutral Point of Wings). E. Kuhle. (Report of the DV.L.) On conventional wing shapes a neutral point may be defined. This is a point at which the pitching moment is independent of the angle of incidence, within a reasonable tolerance. A calculation method of this point is given for wing contours at which lift distribution along the span is known. A very simple approximation method may be used for wing contours which have no bulges (engine nacelles, cut-outs, etc.). The results of two examples are compared with wind tunnel measurements. *Luftfahrtforschung*, September 20, 1940, pages 257–266.

Flugerfahrungen mit Sturzflugbremsen im Segelflugzeug (Experiences with Air Brakes during Glider Flights). H. Schreiber. Air brakes for gliders have been developed from spoilers. The first glider known to be equipped with spoilers was the "Rhoen-Sperber." Braking devices described include: (1) A braking surface on the suction side as well as on the pressure side of the wing. Both these surfaces are extended simultaneously. (2) A breaking surface on both suction and pressure sides which are extended horizontally like drawers. Size of the surfaces are 90 cm. by 13 cm. (3) A breaking surface 240 cm. by 13 cm. hinged to the suction side, close to the nose of the wing. *Schweizer Aero-Revue*, September 1940, pages 274, 275, 4 illus.

Control of the Boundary Layer. Peyton Autry. Different methods are shown for eliminating the turbulent layer of air which forms on the upper rear surfaces of a wing. Included are (a) a pressurized wing with a backward opening slot at the laminar separation point, (b) a blower mounted in the wing for the same pur-

pose, (c) a suction system by means of which turbulent air is withdrawn from the upper wing surface and discharged through the trailing edge into the downwash. N.A.C.A. tests on a wind tunnel model of the pressurized wing produced increases in the maximum lift coefficient of 96 per cent and decreased the minimum drag coefficient 27 per cent. Differences in wing sizes for a given load are shown together with comparative curves for a typical wing. *Aero Digest*, December 1940, pages 114, 116, 7 illus.

On the Calculation of the Boundary Layer. L. Prandtl. The field of viscosity forces in fluid currents of low viscosity is frequently confined to a narrow zone in the vicinity of the surface. Outside the boundary layer, the flow may be assumed frictionless, and because of the small extent of the boundary layer perpendicular to the surface, the pressure therein may be assumed equal to pressure exercised on the surface by a frictionless flow. In this paper, solutions of hydrodynamic equations are examined in application to viscous fluids "disregarding the boundary layer." A method of calculation is suggested, for the case of an initial profile of the expression $u(x_0, y)$ and a pressure distribution with the area of the term $p(x)$. *Journal of the Royal Aeronautical Society*, November 1940, pages 795–801.

500 Miles—and Faster. Raoul J. Hoffman. The Wright brothers' first airplane had a top speed of 35 m.p.h. The modern pursuit airplane is approaching 500 m.p.h. The changes in fuselage shapes, wing curves and general streamlining that contributed to this increased speed are described and explained. The work of the N.A.C.A. and other research groups on supersonic speeds and jet propulsion is also discussed. *Flying and Popular Aviation*, December 1940, pages 41, 81, 83, 1 illus.

Canada's New Aerodynamic Laboratory Nearly Completed. Hugh D. Denison. Features and facilities of buildings for a new research center now under construction near Ottawa, Canada. *Commercial Aviation*, November 1940, pages 40, 42, 2 illus.

Air Transport

Flying Over U.S. Air Mail Route No. 1 on Its 20th Anniversary. Earl N. Findley. An account of the writer's flight over the first complete transcontinental route in a passenger airplane twenty years after the founding of the service. *U. S. Air Services*, November 1940, pages 14, 15, 34, 1 illus.

Fur Coated Fliers. Keith Petrich. The author states that there are more airplanes per capita and more airports per town in Alaska than in any of the states or other territories of the United States. Alaskan flying differs from other types of operation in the type of aircraft used as well as the operational problems which the pilot must face. This article recounts some of the adventures of pilots in the country where transportation changed from dog sled to airplane in two decades. *Air Trails*, January 1941, pages 15, 54, 55, 4 illus.

Shipment by Air. W. A. Rogers. The story of air express from the early days when it was an experiment up to the present. Facts and figures on the growth of air express as a standard carrier of goods are given, showing how it is changing regular business practice. *National Aeronautics*, November 1940, pages 18, 19, 1 illus.

Rags to Riches Airline. Milton Van Slyck. While the feeder air lines may not receive much publicity, they get their share of the airline business. Inland Airlines, one of the "narrow gage" air carriers, began with a single airplane ten years ago, carrying sightseeing passengers as a sideline to their charter and transport business. This article is the story of how the one airplane grew into one of the most profitable feeder systems in operation today. *Flying and Popular Aviation*, December 1940, pages 32–34, 74, 6 illus.

Free Flights for Cash. Doris Ahnstrom. Free samples of merchandise is one of the oldest selling practices known to salesmen. The airlines applied it in the form of courtesy flights, carrying wives, children and skeptics. Facts and figures on this practice with an estimate of the new business it has produced. *Flying and Popular Aviation*, December 1940, pages 38, 39, 3 illus.

Cruise Below the Equator. Burton Luscombe. The war in Europe and the Far East has encouraged winter tourists from the United States to travel in the Western Hemisphere. A factor in increased air travel to the Latin American countries is the special "tour rate" which the C.A.B. has permitted Pan American Airways to offer. This article contains a description of several air cruises to famous and picturesque places below the Equator. *Airlanes*, November 1940, pages 14, 15, 24, 6 illus.

Airplane Descriptions

The Sportsman Test Pilot. James B. Taylor, Jr. Description of equipment and performance characteristics of the Piper Cub Coupe and the three-place Piper Cub Cruiser. The Coupe is a two-place, side by side lightplane powered with a 65 hp. engine. The Cruiser is described as a three-place general utility airplane for the average operator or private owner who desires the most airplane for the least cost. Interior finish is not as luxurious as the Coupe, nor is the engine completely cowled. It is powered with a 75 hp. engine. Other comparisons of handling and performance are given. *The Sportsman Pilot*, November 15, 1940, pages 12, 13, 32, 4 illus.

Nazi Fighter. A structural and design analysis of the Messerschmitt Me-109 from the standpoint of its performance as a fighter. It is stated that thus far the Me-109 has borne the full burden of air fighting for Germany and the belief is expressed that the reason it was not developed into a better fighter with cleaner design is that the Luftwaffe thought that it could bomb its way to a quick victory, thereby relegating fighter airplanes to a secondary role. Several design features and a complete instrument and cockpit layout are shown. *Flight*, October 24, 1940, pages 347–350, 12 illus.

The Heinkel He-115. Description of a twin-engined mine-laying seaplane, developed from the He-115 civil mailplane which set a world's record in March 1938, by covering 1,240 miles at 204 m.p.h. with a load of 4,400 pounds. Dimensions and performance figures are given. *The Aeroplane*, October 25, 1940, pages 445, 456, 8 illus.

Dive Bomber. Description of the Curtiss-Wright XSB2C-1 dive bomber, powered by a 1,700 hp. twin-row Wright Cyclone engine. *Scientific American*, December 1940, page 314, 1 illus.

The Hawker Hurricane. C. M. Poulsen. The history of the Hawker Hurricane began with a set of three view sketches made by Sidney Camm, the Hawker Company's Chief Designer in 1935. An account of how the first much-criticized prototype evolved into the R.A.F.'s most used type of pursuit airplane. The technical improvements over the first type Hurricane, as well as a detailed description of the latest craft are also given, with the names of the men chiefly responsible for its development. *Flight*, October 31, 1940, pages 269, 270a–h, 22 illus.

This Is the Hurricane. "Indicator." The writer-test pilot gives his opinion of the Hawker Hurricane. In the article, he claims that this first line fighter can be flown by almost any pilot, after he has mastered the control drill and knows where all the auxiliary controls such as flap adjustments, trimming tabs and propeller controls are located. *Flight*, October 31, 1940, pages 371–373, 3 illus.

Another Douglas. A brief description of the Douglas DC-6 transport, giving its power, weight, capacity and performance, as well as some details of its construction. *Flight*, October 31, 1940, page 381, 1 illus.

Cessna Aids Empire Air Training Scheme. Canada has placed a ten million dollar order for Cessna advanced trainers. The model, known as the Cessna T-50 Twin, was designed and built especially for advanced training in twin-engined airplanes. The T-50 has a cruising range of 750–1,000 miles at approximately 190 m.p.h. and a landing speed of 55 m.p.h. Standard equipment includes wing flaps, hydraulic brakes and retractable landing gear. Power is supplied by two Jacobs L-4M.B engines rated at 225 hp. each, with 245 hp. available for take-off. Construction details are also described. *Commercial Aviation*, November 1940, pages 15–17, 50, 12 illus.

Howard Produces New Light Trainer. Designed for the C.P.T.P. secondary training, the new Howard DGA-125 trainer is a low-wing, tandem-cockpit airplane powered with a Warner Scarab 125 hp. engine. Details of equipment and performance are given. *Commercial Aviation*, November 1940, pages 52, 68, 4 illus. Also *Aviation*, December 1940, page 68, 2 illus.

A Yank in England. Robert McLarren. A brief history of the Grumman airplanes and a complete description of one of the latest, the Grumman G-36A. This is the type which is being supplied to the Royal Air Force. *Model Airplane News*, December 1940, pages 19, 40, 42, 44, 48, 2 illus.

Comment on German Types. Bruce Foster. During the continuous raiding of England by the German Luftwaffe, many enemy airplanes were captured in fair condition, giving British aircraft designers and engineers an opportunity to examine them. This article is an engineer's report on the Messerschmitt Me-109 single-engined pursuit airplane, the twin-engined Me-110, the Junkers Ju-87 dive bomber, and the Junkers Ju-88 and Heinkel He-111K medium range bombing airplane. The structural details of these airplanes are given, with a discussion of probable production methods. *Aircraft Production*, November 1940, pages 347–349, 13 illus.

British Military Aircraft. Descriptions and specifications of current military airplanes as the Blenheim Fighter, Mark I and Mark IV, Defiant, Gladiator, Hurricane, Roc, Sea Gladiator, Spitfire, Fairey Battle, Beaufort, Skua, Wellesley, Wellington. *Aeronautics*, November 1940, pages 84–86, 89–90, 93–94, 16 illus.

Further Notes on Enemy Aeroplanes. These include descriptions of the defensive armor for the Messerschmitt Me-109, the fuel injection system and hydraulic drive supercharger of Daimler-Benz DB-601 aircraft engine, and the automatic pilot of the Dornier Do-215. There are also two pages of interior and drawings of the equipment of the Heinkel He-111K, the Messerschmitt Me-110 and the Junkers Ju-88-Al. *The Aeroplane*, October 18, 1940, pages 432–435, 12 illus.

Airports

The Airport Program Makes a Start. Kendall K. Hoyt. The Civil Functions Bill recently passed by Congress, appropriated $40,000,000 for the creation of an integrated national airport program. Although this, according to National Aeronautic Association President Gill Robb Wilson, is a small sum compared to the need of a long range program, it is a start in the right direction. The writer gives a summary of the airport program and the N.A.A.'s part in it, throwing some light on politics that held the program back. *National Aeronautics*, November 1940, pages 10, 11.

The Airlines' Terminal in New York City. Description and interesting facts about the new Airlines' Terminal building which will be opened in January. *Aero Digest*, December 1940, pages 40, 41, 5 illus.

Solving Airport Snow Problems. The two methods of snow treatment for runways is discussed. On airports in regions cold enough to preclude mid-winter thaws, snow compaction is used. However, in the past few years, more airports have been keeping runways clear of snow with snow blowers. Both methods and the necessary equipment are described. Experiences in their use at different airports are also given. *Canadian Aviation*, November 1940, pages 31, 32, 37, 5 illus.

Armament

A Whitley Bomber Station. Major F. A. de V. Robertson. Account of a visit to an R.A.F. heavy bomber station. The Armstrong Whitworth Whitley bomber is the heavy bomber "backbone" of the R.A.F. It is fast, heavily armed and can carry a heavy load of bombs a long distance. Details of bomb loading and defensive armament are shown. Of especial interest is a close-up of the interior of a Nash and Thompson four-gun, power-operated turret in the tail of the Whitley. Included are notes on the personnel of the squadrons visited and phases of their operations since the war began. *Flight*, November 7, 1940, pages a–e, 10 illus.

Defensive Flails for Aircraft. The use of small, heavy gliders as flying flails to protect the tail or the nose of bombers from fighter attack, and as a trailing movable barrage behind aircraft to deal with night bombers is proposed by A. P. Thurston. The glider is towed by wing tip rather than the nose, at a speed well over that required for normal gliding. Experiments show that it will not go straight, following the towing airplane, but will describe a circle behind it. If the glider is of sufficient weight and of proper design, it will attain a speed equal to that of a projectile, and develop enough kinetic energy to destroy any airplane or balloon with which it may come in contact. The idea of the flail is described and some of its other possible uses are explained. *Aeroplane*, October 25, 1940, 4 illus.

The Turn of the Turrets. Four photographs showing turret-equipped British planes, with brief captions pointing out their strategic value in air combat. *Aeronautics*, November 1940, pages 46, 47, 4 illus.

Biography

Don Smith. Outline of the business career of Don P. Smith, formerly the president and general manager of the Vultee Airplane Company, now head of the Interstate Aircraft and Engineering Corporation. *Western Flying*, November 1940, page 42, 1 illus.

One Woman's War Effort. Biographical sketch of Helen Harrison, a Canadian girl instructor at Air Transport and Training, Toronto, Canada. She has logged 1,700 hours to date, 1,000 of them as an instructor, and has trained air force reserve and civil air guard pilots in South Africa, England and Canada. In addition to interesting phases of her career, her plans for a Women's Auxiliary Air Force for Canada are outlined. *Commercial Aviation*, November 1940, pages 28, 29, 3 illus.

A Career in Aviation. An outline of the career of Thomas A. Morgan, president of The Sperry Corporation. *National Aeronautics*, November 1940, pages 5, 6, 1 illus.

Terror's His Trade. Joseph Harsch. A biography of Field Marshal Erhard Milch of the German Air Force and an interview with him by an American correspondent. *Collier's*, November 30, 1940, pages 11, 62, 63, 1 illus.

Business and Finance

Finance Your Flying. DeWitt Wendell. Times have changed since airplane operators and pilots were considered as poor risks by all financiers. Airplanes can now be purchased at one-third down and the balance on easy payments. How the plan works, its history, its legal phases, and its applications. *Flying and Popular Aviation*, December 1940, pages 37, 76, 78, 79, 3 illus.

Formula for Determining Empire Production Costs. Regulations governing the determination of Empire production costs for the purpose of figuring customs duties and tariffs. *Canadian Aviation*, November 1940, pages 26, 27, 1 illus.

Canadian Customs Tariffs for Aircraft and Engines. A digest of Canadian Tariff regulations and rates since 1922. Present tariff rates are shown in a special panel. *Canadian Aviation*, November 1940, pages 24–26, 1 illus.

Inflation and Profit. Selig Altschul. Inflation, according to this writer, affects the aviation industry just as much as does any other business. It is stated that the obstacles to uncontrolled price rise, such as a surplus of many commodities and broad government control, should keep sharp rises in cost from developing. The relation of the foreign market to aircraft building profits and the condition of the domestic aircraft securities market are also discussed. *Aviation*, December 1940, pages 71, 142.

Design

Shock Absorbing Systems. Walter A. Semion. This article is the first in a series on aircraft shock-absorbing systems. The writer introduces the general problem created by the airplane landing, that of dissipating the accumulated kinetic energy. General types of landing gears in use, and how the shock-absorbing systems are applied to them are described. Tires are considered as an integral part of the landing gear system, but most of the attention is focused on the shock strut. The article outlines the working and use of the pneudraulic shock strut, describing its functions while taxiing and landing. *Aviation*, December 1940, pages 81, 136, 5 illus.

The Case for the Single-bladed Rotor. J. Lauderdale. Continuation of an article in *Flight*, October 3, 1940, presenting design possibilities of a high-speed fixed wing airplane with a single blade rotating wing to be used in take-offs and landings. In flight it would be stopped and lowered to a position along the top of the fuselage, permitting higher speeds and greater wing loading with the fixed wing. *Flight*, November 7, 1940, pages 402–404, 2 illus.

Engines

The Mercedes-Benz DB-601A. Construction details and performance specifications of one of the two standard types of liquid-cooled engines used by Germany. The DB-601 is a twelve-cylinder inverted V-engine used in the Messerschmitt Me-109 and Me-110. *The Aeroplane*, November 1, 1940, page 490, 2 illus. *Flight*, November 7, 1940, pages f, g, h, 391, 12 illus.

The B.M.W.116 Aircraft Engine. Paul H. Wilkinson. A description of the 600-hp., 12-cylinder, inverted vee-type, water-cooled engine, designed to power German advanced training airplanes. *Aviation*, December 1940, pages 84, 152, 2 illus.

Der Wirkungsgrad von Verbrennungsturbinen mit Gleichdruckverbrennung (Efficiency of Internal Combustion Turbines with Constant Combustion). Werner Piening. The theoretical efficiency of the internal combustion turbine, and the simplicity of its design, have caused inventors and designers to devote their efforts to its technical realization. It is possible to create direct rotative energy with this type of engine, and to decrease weight and size, as compared to piston engines. Similar to piston engines two types of internal combustion turbines may be considered; (1) the constant pressure turbine, corresponding to the Diesel engine, and (2) the constant volume turbine, corresponding to the Otto engine.

The article treats the first type in detail. Its efficiency is deduced from diagrams of the circulation process at adiabatic or isothermic compression or expansion, respectively, and also by the utilization of exhaust gas heat, with consideration of the efficiency of the turbine and of the compressor, and of loss of pressure in the pipe lines. Results show that without exhaust heat there is little difference of efficiency at adiabatic or at isothermic compression. However, heating of the compressed air by means of exhaust gases shows advantages at isothermic variations in conditions. Efficiency of the turbine and of the compressor are of great importance. The curves indicate that a partial efficiency of 80 per cent must be reached to get practical results. *Luftfahrtforschung*, September 20, 1940, pages 267–280, 34 illus.

Conveyor System Accelerates Wright Engine Production. A link chain conveyor system is now used to facilitate the painting and processing of cylinders and crankcases in engine production at the Wright Aeronautical Corporation. A description of the system with figures on increased production and material savings. *Aero Digest*, December 1940, pages 118, 119, 8 illus.

Reorganized Menasco Company Steps Up Engine Production. An account of the reorganization of the Menasco Manufacturing Company. Included is a short history of the company, present production plans and facilities, and facts about the present operating management. *Aero Digest*, December 1940, pages 155, 156, 159, 160, 13 illus.

Machine Tool Set-Ups for Producing Franklin Engines. Production methods and sequence in the manufacture of Franklin air-cooled aircraft engines. Special attention is given machining operations and machine tool arrangement. *Aero Digest*, December 1940, pages 140, 143, 144, 11 illus.

A Comparison of Valve Mechanism (Poppet and Sleeve) as Regards Limiting Values of Compression Ratio, Mean Effective Pressure, and Specific Fuel Consumption. Th. Hoock. A survey and analysis of valve systems which show possibilities for increasing the performance of large airplane engines. Special attention is given the Burt sliding sleeve valve and the Cross rotary valve. *The Journal of the Royal Aeronautical Society*, November 1940, pages 802–815, 10 illus.

More Power from Less Engine. E. S. Hall. Six types of barrel engines are critically discussed by the writer. The general principles of the barrel engine are given, with some of the outstanding advantages of the cross head mechanism.

The general background of the barrel type engine and a description of the latest completed engines and their working principles are given. The comparative advantages of the barrel over the crank type engines are indicated. *S.A.E. Journal*, December 1940, pages 504–519, 26 illus.

Factory Equipment

Photocells in Work Production. Photoelectric cells are being used in increasing numbers in the aircraft plants of England. This article is an outline of their uses for alarms, for counting and sorting production and other work. *Aircraft Production*, November 1940, page 358.

Drilling and Riveting. A review of new types of drilling and riveting machines developed in England and the U.S. to speed up production. The Adcock and Shipley angular drilling

machine, the General Electric multiple riveter, the E.M.B. horizontal riveters and several other new production machines are described. *Aircraft Production*, November 1940, pages 59–61, 6 illus.

A Modern Social Center. Notes on the welfare and cafeteria building recently erected by the Airscrew Company, Ltd. The entire ground floor is devoted to kitchen and dining facilities for both staff and workmen, except for a billiard room. On the second floor is a dance hall which can also be converted into a theater, the stage being in sections so that it can be packed in the storeroom when not in use. There is also a billiard room, table tennis room and bar. *Aircraft Production*, November 1940, pages 364, 365, 5 illus.

Fuels

Fuel for Planes. Announced plan of the joint aeronautical board of the War and Navy Departments for the purchase and storage of high-octane aviation gasoline. Included is a discussion of the grading system, utilization of 115 octane in aircraft engines of greater speed and power, and plans for underground storage. It is also stated that the refining industry is in a satisfactory position regarding wartime production. *Business Week*, November 9, 1940, pages 28, 29, 30.

Gliding and Soaring

When Neighbor Meets Neighbor. Alexis Dawydoff. Glider enthusiasts are increasing the number of local and state gliding and soaring meets. These local meetings of motorless pilots not only produce competition, but focus local attention on the possibilities of soaring as a sport. These smaller meets, locally sponsored and frequently without prizes, are, according to the writer, doing as much to sell gliding to the public as the widely publicized national soaring and gliding meets. *Air Trails*, January 1941, pages 20, 50, 4 illus.

Silent Wings. Commander E. F. McDonald, Jr. The case for gliding as a basis for national defense is presented, giving the German Luftwaffe as an example of trained manpower that can be drawn from the vast number of young men who could be trained, safely and inexpensively, in gliders. A brief description of a course in primary gliding, and examples of how gliding experience made men better fliers of powered aircraft is also given. *Collier's*, November 30, 1940, pages 12, 13, 64, 67–69, 3 illus.

1940 American Open. Robert F. Blaine. A report on the 1940 American Open Soaring Contest held at Lockport, Ill. Prizes and prize winners are listed. *Soaring*, August-September 1940, pages 4, 5, 13, 2 illus.

High Altitude Flight

Avonturen op komst in de Stratosfeer. (Adventures in the Stratosphere.) Professor Low. Information on phenomena in high altitudes gathered by sounding balloons was practically the only kind available until Professor Piccard made his famous balloon flight. Since then great interest in this unexplored field has been aroused. According to the writer, rocket ships for exploration purposes are not impossible. He believes that exhaustive data on the stratosphere will not only effect aeronautics, but also our every-day life. *Luchtvaart*, September 24, 1940, pages 345, 346, 1 illus.

History

The Marines Form a Colorful Branch of Aviation. T. M. Sandifer. The story of Marine Corps aviation from 1917, to date describes the humble origin of the service, its rapid development and its heroic record during the World War. Also included in the article is a list of the requirements for enlistment, rates of pay for officers and a description of the training course. *U.S. Air Services*, November 1940, pages 13, 36, 1 illus.

Flying, as it was. Alys McKey Bryant. How the author became the first woman flier on the West Coast in 1912 when pilots taught themselves to fly. Her flying career began in the summer of 1912 when she answered an advertisement for a young lady to learn to fly for exhibition purposes. Having helped to rebuild an airplane which had crashed, she had her first hour of "grass cutting." A few minutes later the airplane was again wrecked by one of her instructors. Many interesting details of construction of early airplanes and exhibition flying are described in this first-hand account of the pioneering days of aviation. *The Sportsman Pilot*, November 15, 1940, pages 18, 19, 35, 36, 38, 6 illus.

Aviation's 37th Milestone. Captain Bernard L. Brooks. A pioneer aviation writer and U.S. Army pilot relates the story of the first years of flying as he saw it, from the Wright's first flights to the first regular air mail in 1919. *National Aeronautics*, November 1940, pages 12, 13, 31, 2 illus.

New Planes from the Old. Leland Dayton. Many of the recent changes in airplane design, such as tricycle landing gear, inboard motor installation and opposite rotating propellers, were known and used in the early days of flying. The writer proves his point by producing examples of early type aircraft which applied principles and devices which many people think are completely new. *Model Airplane News*, December 1940, pages 8, 9, 60, 61, 10 illus.

Instruction

Tyro Trouble-Shooter. Sam King. The writer, the son of an English professor at a women's college, goes to an aviation mechanic's school. He gives an intimate study of student life at Parks Air College. *Air Trails*, January 1941, pages 18, 46, 6 illus.

Sweat Plus Brains Plus Training. Bert Andrews. Outline of some of the many training plans for the development of skilled mechanical labor. Community plans aided by hundreds of companies with defense contracts are doing much to overcome a tremendous shortage in skilled mechanics and machinists. *Popular Science*, January 1941, pages 86–89, 5 illus.

Co-pilot Material and Their Training. Otis Bryan. Outline of methods of selection and training co-pilots by Transcontinental and Western Air, Inc., as discussed by their chief pilot. Sources of pilot material, desired qualifications and preliminary tests for applicants are also described. *Paper delivered before the National Safety Council, Annual Meeting of the Aeronautical Section.*

Training Mechanics for Safe Air Transport Service. Robert J. Smith. Braniff Airways' four-year training plan for apprentice mechanics is under the supervision of a joint committee of employees and management. Applicants are carefully selected, and their instruction calls for class work three nights a week, two hours per night for nine months in each year. Subject matter of the course and the coordination of day work with evening studies are described. *Paper delivered before the National Safety Council, Annual Meeting of the Aeronautical Section.*

Training Mechanics for Safe Air Transport Operator. T. J. Healey. Apprentice plan of American Airlines, Inc., is presented by its Supervisor. Foreword from the book "Standards of Apprenticeship" is quoted to illustrate the company's convictions about the value of organized apprentice training. *Paper delivered before the National Safety Council, Annual Meeting of the Aeronautical Section.*

Van Sportvlieger tot 2e Vlieger-Luchtschutter (From Sports Pilot to Military Pilot). An account of the military training of sports pilots in Dutch East India. *Luchtvaart*, October 8, 1940, pages 362–366, 8 illus.

Republic's Training Plan at the Faust School. Report of progress being made in Republic Aviation's employee training program to provide it with 8,000 semi-skilled aircraft workers. The plan has been published from time to time in newspapers and the news columns of aviation publications. This article gives a more complete account of the program developed by the company in cooperation with the Faust Aircraft School at Jericho, New York. *Aero Digest*, December 1940, pages 48, 49, 152, 188, 8 illus.

Kneepjes bij het Mitrailleurschieten (Hints on the Operation of Machine Guns). Accompanied by diagrams this article gives some practical hints on the operation of machine guns from airplanes, to assure accurate fire. *Luchtvaart*, September 24, 1940, pages 354, 355, 4 illus.

The Development Division. Jack R. Cram. Acting Chief of the Development Division, Civil Pilot Training Service tells of the work of his department. Hours of planning, study and conference were needed to develop material for training plans, texts and instructions used in the program. Speeding of defense plans has necessitated changes in the program, extending its scope and quickening its pace. Emphasis has changed from the development of civil pilots to primary training of pilots for the Army and Navy service arms. Courses and texts for 1941 are outlined. *The Sportsman Pilot*, November 15, 1940, pages 9–11, 48, 4 illus.

So You Want to Fly? Hugh S. Denison. Survey of the plight of Canadian commercial air schools. While private citizens are becoming more and more air-minded and the demand for private instruction grows steadily, flying schools are faced with a shortage of instructors and equipment. *Commercial Aviation*, November 1940, pages 18–20, 7 illus.

CPTP Looks at Its Accident Record. Grove Webster, director of the Civilian Pilot Training Program, warns school operators that they must benefit by each other's mistakes. He gives an analysis of 222 accidents involving C.P.T.P. students and instructors, showing the predominant causes and suggesting remedies. *National Aeronautics*, November 1940, pages 14, 42.

Can You Fly? John R. Hoyt. Psychological tests can almost always show whether or not a person will make a proficient pilot, according to this writer. A list of tests on "primary abilities" shows whether a man can "size up" the characteristics of a strange airport. Mathematical tests, applied to mental problems in navigation, show that the subjects who pass with a high rating usually make good pilots.

Memory and inductive reasoning also have an important relation with the individual's chances of being successful as a pilot. Apparatus for measuring brain waves sometimes reveal abberations such as tendencies toward epilepsy. Physical tests show that men with wide shoulders and those not too dependent on either their right or their left hand are indicated to be superior pilot material. *Flying and Popular Aviation*, December 1940, pages 30, 31, 56, 58, 6 illus.

Want a Job? William Hurd Barrett. Aviation needs men who have aptitude for hard work even though they may possess neither skill nor experience. A review of the "bottom of the ladder" jobs in aircraft production showing opportunities and the general background needed. *Flying and Popular Aviation*, December 1940, pages 43, 44, 70, 1 illus.

Wings of Gold. B. T. Guyton. The story of the making of a Navy pilot, from the Medical Examiner's office to the cockpit of a dive bomber. The writer relates his personal experiences in the U.S. Navy's training stations at St. Louis and Pensacola, flying training airplanes, fighters, bombers and patrol airplanes. Life aboard an aircraft carrier is also described. *National Aeronautics*, November 1940, pages 7–9, 42, 5 illus.

W.P.A. Announces Program for Aviation Ground Work. Details of a plan to train 5,750 airport maintenance and service men. Trainees will be taken from the W.P.A. rolls and given two to three months' training at airports designated by the C.A.A. *Civil Aeronautics Journal*, November 15, 1940, page 474.

Lowry Field, Colorado. A history and description of the Air Corps Tactical School facilities at Denver, Colorado. *U.S. Air Services*, November 1940, page 19.

Instruments and Instrument Flying

Remote Indicating Compass. Bill Green. Description of the Remote Indicating Compass, manufactured for airplanes and boats by the Engineering Laboratories, Inc., of Tulsa, Okla. *Southern Flight*, November 1940, page 12, 1 illus.

Bank Indicator. A discussion of the functions of the ball bank indicator and its particular use in indicating skidded turns. *Air Facts*, November 1940, pages 21–23.

From X-Rays to Aircraft Instruments in a Year. G. H. Mosher. In 1938 C. P. Horsley, Chief Design Engineer for the Picker X-ray Corporation of Cleveland, moved to Toronto to start his own X-ray equipment company. Today, Sutton-Horsley has a half-million dollar backlog of orders, but not for X-ray equipment. During the past year they have entered the aircraft instrument field, and are producing aircraft signal lamps, fuel gages, temperature gages, prismatic compasses, wing flap and landing gear position indicators and other aircraft instruments and equipment. *Commercial Aviation*, November 1940, pages 30–32, 6 illus.

Radio Eye Guides Planes to Safe Landing. Description of the Sperry Flightray. The face of this instrument is a cathode ray screen upon which readings of several essential instrument landing units are shown simultaneously. In all, the device shows landing-path, horizon, speed, direction, warning lights for both outer and inner marker beacons and degree of bank, on the face of a single unit. *Popular Science*, January 1941, pages 56, 57, 4 illus.

Visibility Limited. James L. H. Peck. A student's impression of lessons in a Link Trainer. *Air Trails*, January 1940, pages 16, 17, 42, 56, 57, 4 illus.

Il problema del volo strumentale. (The Problem of Instrument Flying.) Publio Magini. Data on studies of instrument flying. Coordination of instruments and flying are considered, together with factors of the psychology of the pilot. *Rivista Aeronautica*, September 1940, pages 387–418, 9 illus.

Fighter Pilot Faces Many Dials. Illustration and descriptive diagram of 43 dials, switches and instruments faced by the R.A.F. fighter pilot. *Canadian Aviation*, November 1940, page 41, 2 illus.

Law

Proposals for Safe Regulations of Charter Operators. O. J. Whitney. A charter operator suggests minimum regulations for charter operators as safeguards against inadequate pilot experience and flying equipment. *Paper delivered before the National Safety Council, Annual Meeting of the Aeronautical Section.*

Property Rights in Airspace. Professor James J. Hayden. Article continued from the October issue of *Aero Digest*, citing court cases to prove various points about legal rights in the airspace above property. *Aero Digest*, December 1940, pages 89, 90.

Uniform Airport Traffic Control. Major John Berry. Desirability of Federal traffic control for airports. Problems of airport traffic control are outlined and the suggestion made

that all airplanes should be factory equipped with at least a radio receiver. Crowded conditions resulting from airport traffic together with the problems of uncontrolled private fields surrounding the busy air terminal, are discussed. *Paper delivered before the National Safety Council, Annual Meeting of the Aeronautical Section.*

Il Trattamento Giuridico dei Paracadutisi nel Diritto Internazionale Areo di Guerra. (Juridical Status of Parachutists in International Martial Air Law.) Dr. Massimo Mazzanti. The use of parachutists by Germany during the occupation of Holland and Belgium aroused the Allies. They claimed that such an attack does not conform to international law, and that these parachutists were to be treated as spies. Some uncertainty has arisen about the legal treatment of parachutists who are disguised. The 1907 agreement of Aja fixes the legal status of a spy. Elements necessary for the act of espionage are secret activities, gathering of information and its communication to the enemy and entering the zone of operation of the enemy. The opinion is advanced that these classifications do not apply to parachutists. *Rivista Aeronautica*, September 1940, pages 277–386.

Regulation of the Charter Operator. Jerome Lederer. Reasons for the regulation of charter operators are presented by the director of the Safety Bureau of the C.A.A. While his views do not reflect those of the government, he outlines a list of regulations which should govern the equipment, pilots and flight preparations of charter operators. *Paper delivered before the National Safety Council, Annual Meeting of the Aeronautical Section.*

Lighter-than-Air

The Dirigible Is Dead! Lieut. Col. Karl S. Axtater and Richard G. Hubler. According to the writers, one of whom is a veteran of over 3,000 hours of lighter-than-air time, airships are slow, expensive, unwieldy and dangerous. Against the advocates of dirigibles, who have asked Congress to include appropriations for "no more than thirty-six rigid airships" in the current national defense program, they marshal comparisons such as the new Douglas B-19 bomber that can carry a total load of 28 tons for long distances.

The high cost of building, maintaining and servicing airships, as well as the cost of training their crews, is compared with the less expensive heavier-than-air equipment. The dirigible's relative slowness, its inability to outrun storms, and its size as a military target are also presented against it. The article is an obvious rebuttal to an article written in favor of dirigibles by Commander Charles E. Rosendahl in the same publication in a recent issue. *Flying and Popular Aviation*, December 1940, pages 18, 19, 58, 60, 3 illus.

Balloon Crew Makes Rip-Panel Landing During a Practice Flight Across Ohio. Training flight by Lieut. Comdr. Karl Fickes of the U.S. Navy and a student during which a rip-panel landing was made to avoid trees. Included are five photographs of the actual landing. *Life*, December 2, 1940, pages 34, 35, 10 illus.

La Republica Argentina Realizera la Primera Ascension Estratosferica en el Hemisferio Austral. (Argentina Will Make the First Stratosphere Flight in the Southern Hemisphere.) Eduardo A. Olivero. Plans are being made in Argentina for the first stratosphere flight in the southern hemisphere. The scientific program of this flight will include the study of (1) Cosmic rays, (2) Secondary rays, (3) Atmospheric potential, (4) Ionization of the air, (5) Electrical conductivity of the air, (6) Ultraviolet rays, (7) Meteorological phenomena, (8) Solar constant, (9) Spectrum of the sun, (10) Composition of the air, (11) Micro-organisms, (12) Polarized light. Details of preparations are described. *Aeronautica Argentina*, July-August 1940, pages 1829–1832, 1867, 1968.

Maintenance

Private Airplane Maintenance. A picture survey of the types of maintenance facilities available for private aircraft. *Aviation*, December 1940, pages 60, 61.

Private Engine Maintenance. A survey in pictures of typical shops offering engine service to non-commercial airplane operators. *Aviation*, December 1940, pages 56, 57, 10 illus.

Maintenance for the Private Owner. Frank Say. Many private owners of aircraft do a certain part of their own maintenance. This varies from simple daily checks to top overhauls depending on the skill of the airplane owner. This article outlines the routine for daily checks, twenty-five, fifty and one hundred hour inspections of aircraft, as well as directions for special inspections of propellers, magnetos, fuel analyzers, generators and instruments. *Aviation*, December 1940, pages 52, 53, 126, 138, 5 illus.

Naval Reserve Maintenance. Like any other naval base, the Naval Reserve Base at the Floyd Bennett Airport at Brooklyn depends on a series of rigid inspections for keeping its flying equipment in condition. This article is also a picture-story of maintenance procedure at Floyd Bennett. *Aviation*, December 1940, pages 42, 43, 10 illus.

4-Engine Overhaul Era. William Maxfield. Servicing the Stratoliners in the TWA shops has given rise to new problems in aircraft maintenance. Shop equipment, which for the last five years had served the Douglas DC-2s and DC-3s, had to be rebuilt, extended and enlarged. The flight engineer, a new member for landplane crews, had to be selected and trained. The ground personnel had to accustom themselves to handling an airplane nearly twice the size of former transports. This is an account of the changes in shop, equipment, personnel training and aircraft handling which the arrival of the Boeing 307-Bs incurred. *Aviation*, December 1940, pages 44, 45, 130, 2 illus.

Cleaning Metal Parts. A description of the special machines of Dawson Brothers of Gomersal, England, for cleaning parts of aircraft engines which have been disassembled for overhaul. *Aircraft Production*, November 1940, page 366, 4 illus.

"Send it to the Depot—." U.S. Army Air Corps maintenance is divided into three classifications, or echlons, in Army parlance. The first is field maintenance, such routine adjustments as can be made without the aid of shops, using only the tools a mechanic can carry. The second handles repairs of a more complex nature, requiring the use of engine and sheet metal shops and light repair machinery. The third takes care of complete overhaul. This work is handled at four bases, located at Fairfield, Ohio; Middletown, Pa.; San Diego, Cal.; Texas and Sacramento, Cal. The work at the Middletown depot is described and illustrated with a series of pictures. *Aviation*, December 1940, pages 32, 33, 152, 10 illus.

Maintenance at Fairfield Depot. An account in pictures of some of the work at the U.S. Army Air Corps overhaul base at Patterson Field, Fairfield, Ohio. Also an article on the Unsatisfactory Report System, through which the Field Service Section of the Materiel Division of the Air Corps keeps a record of maintenance and the condition of aircraft on all of the Army fields. *Aviation*, December 1940, pages 34, 35, 7 illus.

Maintenance at Mitchell. A picture survey of maintenance at Mitchell Field near Mineola, Long Island. At this post, squadron mechanics are assigned to specific airplanes, carrying out daily and periodic inspections. *Aviation*, December 1940, pages 36, 37, 12 illus.

Salt Water Maintenance. The maintenance routine of Naval Air

Stations differs from that of the Army Air Corps. Each Naval Air Base is equipped to handle all phases of airplane maintenance including major overhaul. This article includes a picture review of the overhaul equipment at the North Island base in San Diego, California. *Aviation*, December 1940, pages 38–41, 130, 20 illus.

Manufacture

Rubber Die. A description of the Guerin process, the use of a thick rubber pad instead of a second die in the forming and blanking of airplane parts from sheet metal. The Douglas Aircraft Company has been able to lower costs and speed production by using this method. *Scientific American*, December 1940, page 314.

The Use of Rubber for Producing Sheet Metal Parts. Chris J. Frey and Stanley S. Kogut. Continued from the November issue of *Aero Digest*, this article deals with problems of hydraulic press work with rubber used to replace male or female metal dies. Press limitations and material limitations and characteristics under pressure are discussed. *Aero Digest*, December 1940, pages 147, 148, 151, 152, 14 illus.

Engineering Problems of Assembling the Douglas B-19 Bomber. The wing and center section of the B-19 was built in a vertical assembly jig. How it was lowered into a horizontal position for assembly with the nose and tail sections is described. *Aero Digest*, December 1940, pages 130, 131, 9 illus.

Aircraft Manufacturing in Canada. Ronald A. Keith. Canadian aircraft manufacture is being speeded by finding American and Canadian equivalents for English materials, and by closer cooperation with the American aircraft manufacturing industry. Current production and expansion plans of each Canadian aircraft manufacturer are reviewed under the subheads of (a) Orders, (b) Developments or Progress, (c) Plants or Properties, (d) Officers. Companies include Canadian Associated Aircraft Ltd., Boeing Aircraft Company of Canada Ltd., Canadian Car and Foundry Company Ltd., Canadian Vickers Ltd., Cub Aircraft Corporation Ltd., De Havilland Aircraft of Canada Ltd., Fairchild Aircraft Ltd., Fleet Aircraft Ltd., MacDonald Bros. Aircraft Ltd., National Steel Car Corporation Ltd., Noorduyn Aviation Ltd. and Ottawa Car and Aircraft Ltd. Airplanes produced by these companies are listed with brief data on performance. *Canadian Aviation*, November 1940, pages 19–23, 46, 13 illus.

Nine Months Civil Aircraft Output up 69.7 Percent over 1939 Period. Summary of production statistics for the first nine months of 1940. Total number of units produced was 4,543, of which 3,348 were light airplanes of 70 hp. or less, and 919 were in the 70 to 165 hp. class. It should be noted that these figures are for civil aircraft production only, and do not include figures for bomber and fighter aircraft output. *Civil Aeronautics Journal*, November 15, 1940, pages 473, 484.

Pressure on Manufacturers Requires Change in Production Methods. A proposal that, in view of the tremendous number of airplanes on order, a change be made in the American production system to make it similar to that now used by Germany. This would entail (1) a development industry to make and test new models and (2) a mass production industry to turn out accepted "frozen" types by the thousands. Included is a discussion of the latest Army procurement program for 20,000 additional aircraft and the 12,000 additional bomber order for Britain. *American Aviation*, November 15, 1940, pages 1, 24, 25.

Call for Doubling Plane Program. The number of aircraft on order from American airplane manufacturers is about to be increased from 35,000 to 70,000. Fabrication of the second 35,000, it is stated, may start in the Detroit automobile plants and be completed in fifteen new assembly plants being considered for the Detroit area. Concern of Washington and the British about the output of combat airplanes is noted. Deliveries to Canada and England have averaged between 300 and 350 airplanes per month since July, compared to slightly more than 200 a month for the first four months of this year. *Business Week*, November 9, 1940, page 30.

Further Expansion Plans of the Aviation Industry. Survey of expansion plans and details of new plant facilities of Curtiss-Wright, Douglas, Edo and Bendix. *Aero Digest*, pages 44–47, 5 illus.

So, You Want to Build an Airplane. James S. Ricklefs. The hypothetical airplane manufacturer is taken through the steps of design, development, construction and obtaining approval for his first airplane. *Aero Digest*, December 1940, pages 106, 109, 110, 5 illus.

The Airspeed Oxford (Part 2). Wilfred E. Goff. This is a continuation of the description of the Airspeed Oxford twin-engined advanced type training airplane and its production. Part 1 was printed in the October issue of the same publication. This instalment treats with the production of sub-assemblies of wing structures by sub-contractors and the complete assembly of the wings. *Aircraft Production*, November 1940, pages 350–356, 17 illus.

Five Year Plan. J. Stanley Smithson. When North American Aviation began operations in its new plant at the Los Angeles Airport in 1936, provisions for possible expansion were part of its plans. How that plan has materialized in less time than its originators foresaw is told by the works manager of North American's Inglewood plant. *Western Flying*, November 1940, pages 28–30, 5 illus.

Planned for Production. B. G. Reed. With a new plant begun a little over a year ago now in production, Northrop Aircraft is already at work on an extension which will more than double present floor space. Some of its modern design features are described by the engineer who is in charge of the project. *Western Flying*, November 1940, pages 34, 35, 3 illus.

Project Engineer. Frank Cunningham. Described as the man who has to know everything, the project engineer of an experimental model, or a new type of an existing airplane, has the job of finding all the answers to all the questions about it. Requirements of this work in which an immense fund of knowledge is called for are outlined, most of the material being presented as an interview with Schuyler Kleinhans, assistant chief designer for the Douglas Aircraft Company. *Western Flying*, November 1940, pages 47, 49, 56, 3 illus.

America Goes to Work on Aircraft Production. Despite the tremendous backlogs of most American aircraft manufacturers, reports show that the industry as a whole is working at only an estimated 65 per cent of present capacity. Among factors contributing to lag in production speed-up are (1) shortage of skilled workers in the foreman and supervisor category, (2) delivery schedules which can be too easily met with five-day production weeks and (3) the problem of meeting the added costs of capacity production. While plants are being expanded at a tremendous rate the fact remains that average exports to Canada and Britain, including airplanes for France which were taken over by Britain, were 214 per month for the first four months of 1940. A list of 39 aircraft manufacturers in the United States is given together with a summary of expansion plans of several of the larger companies. *Commercial Aviation*, November 1940, pages 24, 25, 32, 6 illus.

Cub of Canada Completes New Plant. Details of the new Cub Aircraft Ltd. plant and flying school at Hamilton, Ontario. *Commercial Avia-*

tion, November 1940, page 36, 2 illus.

"Warplanes While You Wait." Discussion of a feature article from a Canadian newspaper in which Harry N. Atwood, of Greenfield, N. H., and Alex Johnson of Vancouver, Canada, offer to produce plastic airplanes powered with a fabricated steel engine in unlimited quantities. *Commercial Aviation*, November 1940, pages 34, 48, 2 illus. (See also **Baked Engines,** *Flying and Popular Aviation*, November, pages 27, 28.)

The Extrusion Process of Valve Production. Description of the method of making valves by extruding them through dies, as used by Daniel Doncaster & Sons, Ltd. Apparently only two operations are performed on the heated steel slug, roughing and finishing. Advantages are claimed in grain structure. *Aeronautics*, November 1940, page 53, 2 illus.

Machine Tools. Account of machine tool production and the problem of the Industry's expansion to meet the ever-growing needs of American rearmament. What they are, how they are made and the work they do is described in a visit to the machine-tool plant of Pratt & Whitney (no connection with the Pratt & Whitney Aircraft Division of the United Aircraft Corp.), in East Hartford, Connecticut. Details of the manufacture and operation of a gear grinder are shown, together with interesting notes on measurement of extremely fine tolerances by the use of Hoke blocks. *Life*, December 2, 1940, pages 85–93, 24 illus.

Standardization Takes the Spotlight. The final day of the S.A.E. 1940 National Aircraft Production Meeting was devoted to the problem of standardization in aircraft building. This article contains a digest of most of the discussions on standardization and its use as a production tool to speed up national defense.

A summary of the arguments for and against absolute standardization of aircraft, as well as agreements on the reciprocal lending of dies and tools between factories, is also presented. Comments on papers read by T. P. Wright, J. T. Thompson and Gustaf Carvelli are included. *Aviation*, December 1940, pages 66, 67, 146, 148, 152, 5 illus.

Sixty Planes a Day. Guy W. Vaughan. Sixty airplanes of types varying from pursuits and training airplanes to twin-engined transports leave the factories of the Curtiss-Wright Corporation every day. At Buffalo, Paterson, Clifton and St. Louis, the factories are working day and night to fill American and English orders. At Columbus, St. Louis, Buffalo, Caldwell, N. J., and Cincinnati, new plants are being built.

The president describes the factories now in existence and under construction, outlining plans for even further expansion. *Aviation*, December 1940, pages 62, 63, 150, 9 illus.

Line Production Foundry at Wright Aero. Myron B. Gordon. A description of the foundry operations at the Wright Aeronautical Corporation's plants at Paterson and Fairlawn, New Jersey. The construction of sand moulds and cores, the pouring, snagging off of excess metals and the sand blasting and heat treating of castings are all done in straightline production. The article also contains a history of the foundry department of the Wright organization, which was begun by the predecessor company, Wright-Martin, in the early days of the last war. *Western Flying*, November 1940, pages 36, 37, 3 illus.

Photography Speeds Template Making. Joseph Washburn. Description of the giant photographic equipment at the Lockheed Aircraft factory, by which engineer's drawings are reproduced full size upon sensitized metal from which templates are cut. Details and operation of a thirty-four foot camera and its over-sized developing equipment are given. *Western Flying*, November 1940, pages 38, 41, 53, 4 illus.

Is Mass Production Possible? Elizabeth M. G. MacGill. Producing aircraft in quantity, rapidly and at a lower price, is one of the important problems facing airplane manufacturers today. This article outlines both the problems of the airplane designer, who is trying to produce the best performing airplane possible, and the production expert, who is trying to produce large numbers of aircraft of a simplified, standardized design. *Aircraft Production*, November 1940, pages 357, 358.

Designing Loading Charts. C. W. S. Parsons. Another in a series of articles on this important phase of the "paper work" in aircraft production, the designing of loading charts for aircraft subcontractors.

Setting up a system of loading charts enables the subcontractor to tell how many days it will take him to deliver a given job, and aids him in giving more accurate estimates on new contracts.

The article not only tells how a loading chart system can be set up, but makes suggestions as to the training of those responsible for its execution. *Aviation*, December 1940, pages 72, 73, 132, 134, 2 illus.

Bombers in Quantity. Jay P. AuWerter. This is the second in a series of photographs of the interior of The Glenn L. Martin Co.'s plant at Middle River, Md. Steps in the mass production of light bombers and long range patrol seaplanes are shown. *Aviation*, pages 73, 74, 11 illus.

Materials

Investigation on the Spot Welding of Light Alloys. Gordon H. Field and H. Sutton. This article is a report on the strength and behavior of spot welds of light alloys. Welds in duralumin and Alclad of various types and also aluminum-magnesium alloys were examined and tested. The report contains the results of X-ray and microscopic examination, the results of shear tests under varying numbers and conditions of welds, and fatigue tests. The welding of different thicknesses of metals, welds between sheets and the effect of spacing on shear strength were also studied and reported on. *Transactions of the Institute of Welding*, July 1940, pages 157–174, 36 illus.

Welding in Aircraft Manufacture. Hanford Eckman. Fusion welding by the neutral flame method has been largely supplanted in the welding of chromium-molybdenum tubing by the excess acetylene method. Reasons are increased speed, lower temperature with resulting reduction in grain growth, and a tendency toward the elimination of decarburized surfaces on the tubing at the weld. Also described is an automatic vapor flux dispenser which speeds up and improves bronze welding. Details of problems, methods and equipment are shown. *Canadian Aviation*, November 1940, pages 42–45, 9 illus.

Heat Treatment of Steel. Heat treating methods are summarized for various steels to which it is desired to give a hardened case. There is a table giving temperatures and quenching mediums for various steels that are suitable for case hardening. *Aircraft Production*, November 1940, pages 371–372.

Plastics. G. H. Mosher. Outline of the development of plastics in airplane manufacture. Production methods which require only a fraction of the time and manhours of labor consumed in present-day methods of aircraft manufacture, are described. *Commercial Aviation*, November 1940, pages 22, 23, 46, 4 illus.

Tin in Aircraft Construction. W. R. Lewis. Although the use of tin in aircraft construction is not very apparent, the metal serves many important functions. This article is a description of the metal and its uses in aircraft construction. *Aircraft Production*, November 1940, pages 345, 346, 4 illus.

Testing Electric Cables for Aircraft. A description of the method developed by the British Air Ministry for testing aircraft electric cable for cracking and disintegration due to extreme cold. *Aircraft Production*, November 1940, page 346.

Beryllium. Beryllium is the newest of the metals whose alloys are being introduced into the production of airplanes. This article contains a brief history of beryllium, giving its characteristics and uses in aircraft construction. *National Aeronautics*, November 1940, page 19, 1 illus.

Medicine

Air Raid Noise Not Likely to Harm Nervous System Cells. Dr. Clifford T. Morgan. Results of tests to determine the possible effects on the nervous system of air raid noise, explosions or screaming bombs, indicate that any real damage to the human nervous system is unlikely. While tests show considerable emotional disturbance and subjects may become extremely jumpy and sensitive to the slightest sound, any more or less permanent effects of sound exposures are traced to functional changes in the nervous system rather than to any material damage to the nerve cells. *Science News Letter*, November 2, 1940, page 278.

Endurance of Loss of Sleep Tribute to Londoners' Stamina. Physical stamina and mental stability of London's population have been demonstrated by their morale under nightly air raids and the resultant loss of sleep. Effects of loss of sleep over sustained periods are given in a short interview with Dr. W. A. Bousfield, of the University of Connecticut, a psychologist who has for years studied the effect of poor sleep and loss of sleep on human efficiency and morale. *Science News Letter*, November 2, 1940, page 278.

Operational Flying and the Ear. T. S. Littler. Reprint of an article that first sppeared in *Nature*, with an amendment for R.A.F. personnel. It is pointed out that flight personnel show severe but temporary hearing loss after an hour's run unless the ears are protected by a helmet or earplugs or both. Cotton wool soaked in vaseline is an efficient plug. For additional protection against the effects of gunfire, a wedge of rubber held between the teeth is believed to prevent the full shock of an explosion from being conveyed to the ear through the bones of the skull. *Aeronautics*, November 1940, pages 48, 49, 3 illus.

Take a Deep Breath. Denver Lindley. The 1940 Collier Trophy was awarded to the air lines of the United States for their safety record in 1939. However, special mention was made of Doctors Walter M. Boothby and W. Randolph Lovelace II of the Mayo Foundation for Medical Research and Education and to Captain Harry G. Armstrong of the United States Medical Corps for their studies of pilot fatigue and the effects of high altitude flight on the human organism. Effects of anoxemia and experiments in a special high altitude low pressure tank are described. *Collier's*, November 23, 1940, pages 16, 67, 68, 2 illus.

Signs of Heart Damage from Oxygen Lack at 5000 Feet. Heart tests conducted by the U.S. Army Air Corps show signs of heart damage due to oxygen lack at altitudes as low as 5000 feet. Description of tests using electrocardiograms is given. *Science News Letter*, November 23, 1940, page 293.

Bailing Out at High Altitudes Requires Immediate Oxygen. Details of a laboratory test in which Milo G. Burcham, test pilot for Lockheed, lost consciousness by delaying the use of his emergency oxygen supply only thirty seconds. His test "jump" was made in a low pressure chamber in which flight altitude conditions at 35,000 feet were simulated. He started through the motions of bailing out before adjusting his emergency mouthpiece and lost consciousness before he completed either routine. *Science News Letter*, November 23, 1940, page 292.

Meteorology

Suggestions for Improved Presentation of Weather Information to the Public. G. Emmons. It is held that the special jargon by which the meteorologist describes the isobaric formations on his weather map might well be replaced by the simplified description of cold or warm air-masses and their effect on local weather conditions. Additional improvements recommended for newspaper weather charts include barometer tendencies, location of more important fronts, shading of areas over which precipitation is falling, southern limit of snow cover when applicable. It is also suggested that terminology for local forecasts be clarified and redefined. *Bulletin of the American Meteorological Society*, October 1940, pages 311–315.

Weather Forecasting Terms. H. Landsberg. Redefinition of weather forecast terminology from discussions by the Central Pennsylvania Seminar of the American Meteorological Society. Specific definitions and prescribed limits are given for terms such as partly cloudy, snow flurries and other more or less general terms. *Bulletin of the American Meteorological Society*, October 1940, pages 317–320.

Proposal for Frequent and Dependable Weather Reports from Off the Pacific Coast. William H. Wenstrom. Discussion of present lack of adequate weather reports from off the Pacific Coast. A plan is offered calling for several sea-going schooners to be used as special weather-reporting ships, which would give weather reports several times daily from points some 200 to 250 miles off-shore. It is also suggested that a weather station broadcasting from Guadeloupe Island could warn southern California of the approach of hurricanes, especially during the hurricane season of late summer and early fall. Guadeloupe lies in the path of their usual approach from the south or southeast. *Bulletin of the American Meteorological Society*, October 1940, pages 321–323.

Occlusions on the Alaskan Coast. Archer B. Carpenter. Study of the effect of the Alaskan coastal mountains on the passage of occluded fronts across Alaska. Data showing the structure and behavior of two typical situations are discussed, one in the fall and the other in late winter. *Bulletin of the American Meteorological Society*, October 1940, pages 327–332, 4 illus.

A New Electronic Anemometer. Elbert F. Corwin. Operation principles of a new direct reading anemometer which registers on several remote indicators simultaneously. On the head shaft is a rotating disc with a number of holes punched in its periphery. As these holes pass between two ultra-high frequency coils, a beat frequency proportional to the speed of rotation is set up. Eventually it is amplified, converted into milliamperes and read on a meter with a linear scale from 0 to 100 miles per hour. *Bulletin of the American Meteorological Society*, October 1940, pages 337–340, 3 illus.

Military Aviation

Canada Supplies the Pilots. James Montages. Britain's Royal Air Force must draw heavily on the supply of pilots and other flying personnel, trained under the Empire Training Program, now under way in Canada. Rather than demand flying equipment from the hard-pressed English factories, Canada has sent back to England airplanes already on her fields, and will be ready to replace them with Canadian built aircraft by March 1941. How the cadets are selected and trained, what types of airplanes are used for their schooling, as well as the conditions under which their training takes place are described. Also facts and figures on the entire training program, its courses and its proposed

output are given. *Flying and Popular Aviation*, December 1940, pages 20–22, 68, 70, 5 illus.

American Pilots Report for Action with R.C.A.F. In early October, 184 Americans were serving with the R.C.A.F. Drawn from every part of the United States, they range in experience from a senior airline pilot who quit his Dallas to Los Angeles run to join, to private fliers with hundreds of hours of lightplane experience. Some of their present duties and plans for future training are given. *Canadian Aviation*, November 1940, page 28, 9 illus.

Decorations. Frank Hazell. Descriptions of the Distinguished Flying Cross, Distinguished Flying Medal, Air Force Medal, Air Force Cross, which are confined to the R.A.F., and of other British military decorations, with an outline of requirements for award. *Aeronautics*, November 1940, pages 59–60, 5 illus.

International Air Force. Frank Willcocks. Poles, Czechs, Dutch, French, Belgians and Norwegians now are serving as individuals or in squadrons with the R.A.F. The Poles are the largest group. Brief comments on the air activities of each of these nationalities in England. *Aeronautics*, November 1940, pages 50, 51, 5 illus.

Specialists in the Air Corps. Major Roland Birnn. An air corps needs a great deal more than pilots and mechanics as personnel. Besides flight crews, specialists in many fields are needed to keep a flying force in the air. The scores of well paying trades which the Army Air Corps teaches its enlisted men are enumerated and described. The rate of pay, chances of promotion and opportunity of qualifying for Air Corps Duty are all given. *Flying and Popular Aviation*, December 1940, pages 26–29, 16 illus.

Air Force Uniforms of Other Countries. A. S. Bridgland. The editor of a tailor's trade paper discusses German, Italian, Lithuanian and Mexican air force uniforms. *Aeronautics*, November 1940, pages 68, 69, 3 illus.

What They Are Like. Comments on the character and accomplishments of a number of R.A.F. pilots who have won the Victoria Cross and other decorations during the present war. *Aeronautics*, November 1940, page 77.

Tattica d'impiego dagli sbarranenti aerei. (Tactics in the Use of Balloon Barrages.) Beginning with the history of balloon barrages, dating back to the first World War, the technique of balloon barrages and modern tactics of their use are discussed. Balloon barrages are divided into (1) the "ring-or-wall-system," (2) the "chess board system," (3) the "pin cushion system."

When high winds prevent the use of balloons, kites are substituted. The balloon reaches its maximum altitude at still air and at the smallest angle of inclination toward the horizontal, while the kite, on the other hand, reaches its maximum altitude at high wind, and at a favorable inclination toward the horizontal. According to the English, barrage balloons may be protected by means of explosive charges which are placed aboard, and which are discharged from the ground in case the balloon is attacked by enemy aircraft. In the writer's opinion, this idea seems to have little practical value. *Rivista Aeronautica*, September 1940, pages 448–452, 4 illus.

Performance Forecast for 1941. It is stated that it is not likely that 1941 will see any sensational advances in the performance of military aircraft. The maximum speed probably will be 400 m.p.h., and "there will be no appreciable further increase for five years." This is based on a study of past accomplishments, and on the fact that more guns and armor, which mean more weight, are desirable. Maximum bomber range with full load is not likely to exceed 4,000 miles for five years. *Aeronautics*, November 1940, pages 54, 55, 5 illus.

A Route to North-East Italy. Dr. H. G. Cimino. Suggestions for an air route for bombers through the eastern Alps and the Brenner pass which is 2,700 feet lower than the St. Bernard and other passes used in the west. *The Aeroplane*, October 18, 1940, page 421, 2 illus.

Air Strategy—XXV, Air Blockade—XV. Captain Norman Macmillan. The question is asked whether Britain is at the nadir in her fortunes of war and diplomacy, and the problem is discussed in the light of possible developments in the Near East and the attitude of the United States. The offensive power of bombers and the possibility of great fleets winning a war through a combination of air blockade and destruction of war production centers are described. The writer believes that this can be done without land armies having to decide the final outcome in battle. *Flight*, October 24, 1940, pages 351–353.

The Outlook. Editorial on the need for a coordinator of military aircraft design for Great Britain. The need is expressed for a man to do a similar job to that which Lord Beaverbrook has done for aircraft production. *Flight*, October 24, 1940, pages 337, 338.

As Others See Us. Interview with Polish and Czech squadron leaders of the R.A.F. British equipment and training methods are praised and compared to those of Germany and France Training foreign airmen to fly and operate R.A.F. equipment, and the problem of language differences, are also discussed. *Flight*, October 24, 1940, pages 344a, b, 345, 346. 5 illus.

U.K. as an Advance Striking Base. Captain Norman Macmillan. Striking the base of the enemy to make the front line crumble is a tactical plan which has been used by Germany with success. This fact is advanced by the writer in his suggestion to consider England as an advanced base for the smashing of Germany and Italy as main bases of the enemy. This would make the United States the main base for the Allied Forces. It is also suggested that British population not necessary to war effort be evacuated to the Western Hemisphere so that the British Isles can be "cleared for action as the deck of a ship is cleared for action." Stragetic reasons for the part the United States would play in feeding and providing British "outposts" with munitions, are discussed. *Flight*, November 7, 1940, pages 392, 393, 396.

The Army and the Air. Major F. A. de V. Robertson, V.D. Discussion of the need for a separate Army Air Force for Britain, entirely divorced from the R.A.F. Special observation work of the present Army Cooperation Squadrons warrants their transfer to the Army, it is stated. *Flight*, November 7, 1940, pages 389, 390.

Saving the Bombers. Analyzing the effects of the new German policy of bombing with fighters. Of especial interest are four graphs showing a comparison of British and German losses in airplanes and personnel from the middle of August to the middle of October. In these two months the charts show that the Germans lost 4830 airplanes and 11,335 men, while British losses totaled 1,471 airplanes and 2,881 men. Breakdowns are given for average daily losses, personnel losses and a comparison of fighter and bomber losses. An operations log for the second week in October is also given. *The Aeroplane*, October 18, 1940, pages 427–430, 6 illus.

War Aeroplanes of the World. The great cost of the military airplane is emphasized as a major obstacle to expansion of air warfare, particularly by the smaller countries. It is stated that in 1930–31, about 50% of their war budgets was spent for flying material by 38 countries, while only 25% to 30% was spent by them for military and naval equipment. Costliness is illustrated by taking the price per kilogram of the airplane engine as 100, on which scale guns are rated as 60, shells 40, automobile engines 4 and steam turbines 3. The modern

bomber is claimed to have about 70,000 parts for which from 6000 to 8,000 drawings have to be prepared. There follow brief outlines of the airplanes at present employed by various countries the world over, giving performance figures, armament, estimates of number on hand, when available, and similar information. *Aeronautics*, November 1940, pages 97, 98, 101, 102, 104.

The War in the Air. Further notes on Germany's new policy of using fighter airplanes for quick "tip-and-run" bombing attack. England's need for a 400-m.p.h. bomber with a reasonable cruising range and bomb load for day bombing is emphasized as well as longer range and more fire power for her fighters. *The Aeroplane*, October 18, 1940, pages 426, 427, 3 illus.

On History in the Making—I. C. G. Grey. General analysis and discussion of British air war policies and problems. Included are the political and non-military administrative problems of former Chief of Air Staff, Sir Cyril Newall, a summary of diplomatic and military reverses to date, and some notes on the career of the new Chief of the Air Staff, Air Marshal Sir Charles Portal, and Air Marshal R. E. C. Peirse, new Chief of the Bomber Command. *The Aeroplane*, October 18, 1940, pages 423, 424.

Fighters as Bombers. The use of fighters as bombers over Britain is regarded as a tribute, not a threat, in this editorial. It is stated that the bomb loads carried by Messerschmitt Me-109 fighters are of negligible value against military objectives, while the Me-110 apparently is not equipped for accurate bombing with its heavier load. *The Aeroplane*, October 18, 1940, page 418.

Work for the Bomber. Editorial outlining possible objectives for the British Bomber Command next spring when bomber strength will permit more extended operations. *The Aeroplane*, October 18, 1940, pages 417, 418.

The Cult of Speed. Editorial comment on the fact that the Germans have proved in the past that speed is essential to the success of bombing raids. Their bomber losses and their assignment of bombing missions to fast fighters have clearly shown speed and high altitude to be the best forms of protection for bombers. *The Aeroplane*, November 1, 1940, page 472.

Military Components and Accessories. Broad outlines are given of the more important components and accessories of military aircraft. The comments are classified under the headings of armament, navigation, comfort, refueling and other equipment. *Aeronautics*, November 1940, pages 105, 106.

Het Luchtwapen: Theorie en Practijk. (The Air Forces: Theory and Practice.) With the outbreak of the present European war many theories by well known experts have been expounded. The question arises whether the operations of airpower which some of these experts predict is going to be surpassed by actualities. Will there be chemical warfare?

The writer discusses General Douhet's study, "Domenio dell'Aria," which was published shortly after the World War. Douhet is the apostle of total air war. Many thought his views not practicable, but events have to some extent borne out his predictions. However, the fact has to be considered that the Germans employed the new panzer divisions and fifth column tactics for which no defense was provided. So the question is still open as to whether a country may be defeated by air power only. *Luchtvarrt*, October 8, 1940, pages 377–379.

Entry into the Royal Air Force. Tabulation of the various branches of the R.A.F., showing pay for various assignments, and the qualifications necessary to enter each. *Aeronautics*, November 1940, pages 65–67.

The Work of the Observer Corps. R. A. Saville-Sneath. An account of the activities of ground observers in England, who watch for enemy planes and report their number and course, with brief description of their simple equipment. *Aeronautics*, November 1940, pages 52, 53, 4 illus.

Turning Time. An analysis of the time required for a fighter to make a turn at the end of an attack on a bomber shows that the higher their respective speeds, the more difficult is the fighter's task of preventing the bomber from reaching its objective. In the case of a 250-m.p.h. bomber and 350-m.p.h. fighter, the latter can attack for 30 sec., then make a 180-deg. turn in 5½ sec., while the bomber flies about 2½ miles further toward its goal. But if the speeds are each stepped up 100 m.p.h., the bomber's gain in distance during attack and turn goes up to over four miles. *Aeronautics*, November 1940, page 39, 2 illus.

Towed Troop Carriers. Brian Worley. A technical study of design, performance and operational factors involved in towing one or more heavily loaded gliders behind an airplane. It is based on German ideas as revealed in technical papers. The author points out that if the glider flies higher than the towplane, it will relieve the latter of some of its weight, and that if an "aerodynamically dirty" airplane is towing a very clean glider, the overall cleanliness of the pair can be greater than that of the airplane. A formula is given for calculating the best relative attitudes of each. Other formulas concern glider loading and overloading and cable angle. It is concluded that a Junkers Ju-52 can easily tow a glider of ½ its weight, carrying 14 men, increasing the plane's 17-seat capacity by 80 per cent. If take-off run can be increased considerably, the Ju-52 might handle a 10,000-lb. glider with about 20 men. Speed of the plane would be reduced by about 15 m.p.h. Take-off with a 7,000-pound glider would be increased only 50 yards, while if the same weight were put into the plane itself, the run would be increased by 150 yards. Glider wing loading should be low, but the lower it is, the less can the glider relieve the towplane of some of its load. *Aeronautics*, November 1940, pages 40–45, 12 illus.

Air Strategy in the First Year of War. Captain Norman Macmillan. It is contended that the R.A.F. was ineffectively employed until Dunkirk and the subsequent air attacks upon England. This is held to have been a mistake, on the ground that dropping pamphlets instead of bombs permitted German production to proceed unhampered. It is admitted that during the attack upon the Low Countries and France the major portion of the R.A.F. was kept at home until it became necessary to evacuate the army from the continent. Germany's use of its air force during the Polish campaign is stated to have been purely a tactical function of the army, while in Norway the Luftwaffe was the spearhead of the campaign. The author admits that "the withdrawal of the British forces from Norway was undoubtedly brought about by the strategic use of the air weapon by the German High Command."

A factor of great importance was the disparity between the distances from Norway to German or German-controlled airports, and to British ones, illustrating the fact that the nearer the bases the greater the striking power. In some situations, it is contended, supreme command of all forces has been given to the German air commander concerned in the action, because use of all forces has depended upon the situation in the air. There is a statement that the United States is more awake to new methods of employing air power than is England, and a plea is made for improvement in British air strategy, because "as the weapon of offense the aeroplane must come first." *Aeronautics*, November 1940, pages 34–38, 5 illus.

Military Formation Flight from Los Angeles to Rio de Janeiro. Account of the recent delivery flight of six North American NA-44 light attack-bombers to Brazil. Details of the NA-44 are also given. *Aero Digest*, December 1940, pages 42, 43, 11 illus.

Interceptors Up! John R. Hoyt. The interceptor type airplane is considered by many experts to be the most satisfactory protection against high flying bombers. As important as the fast climbing airplane itself, is the pilot who is trained and conditioned to do this delicate and grueling kind of flying. This article is an account of what the interceptor pilot encounters on his climb to 25,000 feet to meet the enemy, and why flying and fighting conditions in the rarefied air require knowledge, flying ability and stamina far above that which is demanded of lower altitude flying. *Air Trails*, January 1941, pages 10, 11, 48, 49, 4 illus.

Airpower for Defense. James L. H. Peck. Conditions abroad have forced the United States into the position where it must be prepared to defend the entire western hemisphere. Our Army and our Navy air forces, each working as part of their own units of the National Defense, are being put into high gear to face the possibility of direct invasion. This article is a description of the Army and Navy air forces, their equipment, their functions and their methods of operation. Differences in their equipment and methods of training pilots and other personnel are also discussed. *Scientific American*, December 1940, pages 311–314, 4 illus.

Higher and Higher. German aircraft have been encountered flying over England at 37,000 feet. What the purposes of such flights are and what steps would have to be taken to combat enemy airplanes at this altitude are discussed. *Flight*, October 31, 1940, pages 363, 364.

For the Long-range Bomber—. Capt. Norman Macmillan. Five years ago the writer suggested a plan for the placing of long range bombing squadrons in strategic places throughout the British Empire. The Air Ministry never acted on this suggestion. At the present time, such a plan would be valuable to the Empire Defense Plan. In this article a plan is outlined for the reorganization of the Service side of the R.A.F. to facilitate the creation of long range bombing brigades to do some of the work outlined in the original plan submitted in 1935. *Flight*, October 31, 1940, pages 379–381.

Air Power and Future History. John Philips Cranwell. The argument of Air Power *vs.* Sea Power which has divided experts since the last World War is discussed and brought up to date by this writer. It is stated that Sea Power is not merely the number and strength of fighting ships, but the control of water-borne commerce that it commands. The same will probably be true in air-borne commerce. The parallels which are developing between Air and Sea Power and their possible effect on history are discussed. *Harpers*, December 1940, pages 67–71.

On History in the Making. C. G. Grey. A further discussion of current war problems. The necessity for developing new types of aircraft in order to keep ahead of Germany's improvements, is indicated. Three other important problems developed by the war in the air are discussed. (1) The matter of publicity about the billeting of troops in vacant country homes. This has resulted in the bombing of the British countryside and the destruction of many of the beauty spots of England. (2) The business of conducting the war on an impersonal, unemotional, scientific basis. (3) The writer takes to task those who advocate that workers in machine shops stick to their benches despite the peril of bombs. He again suggests that factories be put underground, out of the reach of the enemy aircraft. *The Aeroplane*, October 25, 1940, pages 453, 454, 2 illus.

Airlines on M-Day. James Bassett. The conservatism drilled into an airline pilot is opposed to the daring required for combat work. The writer outlines how both the airliners and the airline personnel would be used in case of war to transport troops and carry military cargo. *Air Trails*, January 1941, pages 19, 65, 66, 4 illus.

Los Factores del Poderio Aereo. (Factors Relative to the Air Force.) Discussion of problems which confront Argentina in building an air force for national defense. These include (1) coordination of military, naval and civil aviation to form a national air force, (2) organization of all resources to support the air force, (3) establishment of priorities for materials and supplies, (4) careful selection of aeronautical material, (5) development of aviation training schools, (6) construction of a complete system of airports and their ground organizations, (7) acceleration of private industry in order to develop the aeronautical capacity of the country, (8) creation of a special department to organize and to instruct reserves for the air force, (9) facilitate acquisition of civil airplanes by pilots of the air force reserve and (10) intensification of aeronautical instruction in all schools and universities. *Aeronautica Argentina*, July-August 1940, pages 1823, 1824, 1868.

I Flew into Battle in a British Bomber. Robert E. Low. The personal experiences of an American War Correspondent who flew in a R.A.F. Lockheed Hudson bomber across the North Sea to raid one of the invasion ports on the Norse coast. *Liberty*, November 30, 1940, pages 12–14, 1 illus.

Norway Flies on. Kurt Rand. A new air force for Norway is being trained in Canada, despite the fact that its homeland is under occupation. The airplanes which were originally ordered by Poland are being taken over and marked with the national insignia of Norway. These are being used to train Norse pilots many of whom have had little combat training. These pilots hope to fight by the side of the English for the freedom of Norway.

Many of the pilots had harrowing adventures, such as arriving in England in lifeboats after the fishing schooners which had been transporting them were sunk by bombs. *Flying and Popular Aviation*, December 1940, pages 35, 36, 4 illus.

Why Hitler's Planes Failed to Beat England. Major Alexander P. de Seversky. In the opinion of the writer, the Blitzkreig against Britain has failed, because the Luftwaffe was not built to conduct a war on its own. Its triumphs in Poland and the Low Countries were possible because it was part of a well coordinated military machine. In the invasion of Britain, Germany has failed thus far because her air force, the only part of her military machine which has been able to strike at Britain, has not been able to deliver a telling blow. The writer gives his views on why Germany's war machine has broken its schedule for the first time, and how the United States might profit by the lessons which are being taught during the present war. *Look*, December 17, 1940, pages 8–11, 9 illus.

Overseas Mission. John C. A. Watkins. An exclusive interview with Ellis D. Shannon, test pilot for the Glenn L. Martin Co., who accompanied the first group of American mechanics sent to assemble light bombers for service in France. Although Shannon had no proof other than the word of the French pilots, it was indicated that the American-built Martin bomber would outrun captured Messerschmitt Me-109's. The low-octane fuel burned by the Germans, the inferior lubrication of their engines which restricted them to a few minutes of full throttle operation and the Martins' ability to keep moving at full power without damag-

ing their power plants, were all important factors in deciding this superiority. *Flying and Popular Aviation*, December 1940, pages 24, 25, 83, 3 illus.

Spotting by Film. Two pages of photographs from a motion picture showing a series of comparative differences between the British Blenheim IV and the German Junkers Ju-88, two types of bomber which look very much alike. Different points from various angles are outlined in white to help in their identification. Sound track of the film completes the comparison by reproducing the difference in engine and propeller sound. *The Aeroplane*, October 25, 1940, pages 460, 461, 28 illus.

We Defend Alaska. Corey Ford and Alastair MacBain. Defense preparations are being rushed in Alaska twenty-four hours a day and seven days a week. This is one of a series of articles on defense preparations in Alaska. Because of its similarity to Norway in terrain and vulnerability, air bases and military aircraft will play a major role in its defense. Army experts say that, like Norway, it will be easier to defend Alaska than to dislodge an invader once he gains a foothold with aircraft and parachute troops. Positions of Russian and Japanese bases are shown and discussed, and work on our bases is described. *Collier's*, November 23, 1940, pages 11, 30, 32, 35, 2 illus.

How to Fight in Alaska. Corey Ford and Alastair MacBain. Last year ninety-five per cent of the white population in Alaska used some form of air transportation. Everything, from cows to grocery stores, goes by air. Airplanes are so much commoner than automobiles that an Eskimo chief actually chartered an airplane and flew south to Nome for the express purpose of taking his first automobile ride. An interesting account of flying conditions in Alaska and the importance of air transport both to its inhabitants and to national defense. The U.S. Army, busily engaged in defense preparations has turned to Alaskan civilian pilots and sourdoughs for information and education in Arctic flying as well as ground operations and maintenance. The C.A.A. in Alaska has been of especial value. Problems of weather and weather forecasting are also described. *Collier's*, December 7, 1940, pages 17, 55–57, 4 illus.

Miscellaneous

Ice-Free Aircraft Windshields Demonstrated in Experiments. Three methods of ice removal from windshields are given comparative flight and ice tunnel tests and the results presented. Three types of equipment were (1) an electric motor-driven rotating wiper, (2) an electrically heated windshield, (3) a hot-air heated windshield. The rotating wiper has an alcohol feed system through the blade shaft and speeds varied from 300 to 2100 r.p.m. The electrically heated unit comprised two glass panels with the quarter inch space between them filled with ethylene glycol containing electric heating wires. The air heated unit consisted of double panes of glass with the air space between them heated by air from the cabin heater. Methods of tests and test results are discussed. *Canadian Aviation*, November 1940, pages 38–41, 46, 8 illus.

Searchlights and Those Who Man Them. Description of the British searchlight crews, which receive their orders from the Royal Artillery. Each light, with its crew, is carried in a single truck and thus is entirely mobile. The beam is controlled on orders from a sound locator device, and also from two spotters equipped with binoculars. *Aeronautics*, November 1940, page 56, 3 illus.

A bullet-sealing tank in the process of installation. The tank, developed by the United States Rubber Company, is shown being installed in a bomber under construction by the Douglas Aircraft Company.

Protecting Gasoline Tanks. Alexander Klemin. Although younger men in aviation look upon the protection of fuel tanks on military airplanes as an innovation, methods for accomplishing this end were known fifteen years ago. The article quotes from a paper written by A. R. Weyl and printed in the *Journal of the Royal Aeronautical Society* in 1925, showing that the principles now in use were thoroughly explored at that time. The metals for making tanks, the formation of baffle plates and the leak-proof covering of fuel cells, as well as their forms and location in the airplane for minimum exposure to machine gun fire are discussed. *Scientific American*, December 1940, page 322.

Electrostatic Precipitation for Aircraft. Howard E. Corbitt and Norman J. Clark. Outline of several systems for purifying and sterilizing air for recirculation in pressure cabins of high altitude transports. Principles and operation of electrostatic precipitators are given in detail. *Aero Digest*, December 1940, pages 132, 135, 136, 139, 166, 6 illus.

Self-Sealing Tanks. Description of self-sealing tanks found on German airplanes. The tanks have a casing of five different layers of material, none of them metal. On the outside is a covering of heavy black vulcanized rubber, then several layers of thin para rubber, next a layer of soft plastic soluble rubber about $^1/_4$ inch thick, compressed tightly and affixed to a thick layer of hide. The inner layer is a thin fibrous material, vulcanized so as to be almost as hard as metal. It is the soluble synthetic rubber that closes a puncture, the gasoline causing it to become more plastic so that it fills the hole. *Aircraft Production*, November 1940, page 356, 2 illus.

Increasing Hose Line Efficiency. Description of Prenco flexible and detachable hose lines and Prenco self-sealing couplings. The latter is a combination coupling and shut-off

Ninth Annual Institute of the Aeronautical Sciences

January 28 to 31, 1941

I.Ae.S. *Ninth Annual Meeting*

- Three days of technical meetings, morning, afternoon and evening sessions, Wednesday, Thursday and Friday, January 29th to 31st. Over forty-five papers (some including demonstrations) in ten different fields of the aeronautical sciences to be read and discussed. An important program of technical reports presented at a time when the advancement and utilization of new knowledge is of the greatest value to everyone concerned with aviation.
- Luncheons at the Columbia University Men's Faculty Club, convenient to the meeting place, at which members may meet each day during the intermissions between technical sessions.
- Annual Business Meeting of the Members of the Institute, Wednesday, January 29th, at 5:00 p.m., at which new members of the Council will be elected and Officers will present reports on the past year's activities and future plans.
- Institute headquarters open on the evenings of Wednesday and Thursday, January 29th and 30th. Members are invited to come and bring their friends to see an exhibition of aeronautical rarities in the Aeronautical Archives.

HONORS NIGHT DINNER

Tuesday, January 28, 1941, at 7:30 p.m.

HOTEL BILTMORE, NEW YORK

Guest of Honor: MR. GRIFFITH BREWER, President of the Royal Aeronautical Society of Great Britain, who will speak on—

"Fifty Years of Aeronautical Experiences"

Toastmaster: MAJOR JAMES H. DOOLITTLE, President of the Institute.

Induction of Fellows, Honorary Members and Honorary Fellow of the Institute for 1940.

Presentation of The Sylvanus Albert Reed Award, The Lawrence Sperry Award, The Octave Chanute Award, The John Jeffries Award, The Robert M. Losey Award, and The Daniel Guggenheim Medal.

Induction of the President of the Institute for 1941.

Announcement of an important gift to the Institute.

Copies of this notice are available for posting on your bulletin board and will be sent on request.

Ladies are invited to attend the Technical Sessions and the Dinner. Registration for three days of the Technical Sessions will be taken at the meeting headquarters at Columbia University. Registration fee is $1.00.

Tuesday **January 28**

7:30 p.m. **Honors Night Dinner**

At the Biltmore Hotel

Wednesday **January 29**

9:15 a.m.

Rotating Wing Aircraft, Part I

Chairman:
Ralph H. McClarren, The Franklin Institute

Possibilities of a High Speed Helicopter—Lloyd H. Leonard, National Advisory Committee for Aeronautics

A Simplified Method of Determining the Characteristics of a Lifting Rotor in Forward Flight—F. J. Bailey, Jr., National Advisory Committee for Aeronautics

The Propulsion of Helicopter Rotors—E. A. Stalker, University of Michigan

Relative Over-All Efficiency of Anti-Torque Systems—W. F. Gerhardt, Wayne University

12:30 p.m. **Luncheon**

Columbia University Men's Faculty Club

2:00 p.m. **Instruments**

Chairman:
Charles H. Colvin, U.S. Weather Bureau

Maps for Long Distance Flights—Bradley Jones, University of Cincinnati

The Daytime Photoelectric Measurement of Cloud Heights—Maurice K. Laufer and Lawrence W. Foskett, National Bureau of Standards

Flight Level Indicator—Robert W. Knight, Civil Aeronautics Administration

The Rate of Turn Meter—P. A. Noxon, Pioneer Instrument Div., Bendix Aviation Corp.

Effect of Compass Location in Aircraft upon Dynamic Errors—Walter Wrigley, Sperry Gyroscope Company

2:00 p.m.

Rotating Wing Aircraft, Part II

Chairman:
Richard H. Prewitt, Kellett Autogiro Corp.

Recent Army Work on Rotor Blades—Victor R. Haugen, U.S. Army Air Corps, Wright Field

nal Meeting

Aonautical Sciences

3 1941, New York ⁘

PROGRAM

(All Technical Sessions held in the Pupin Physics Laboratories, Columbia University, 120th St. & Broadway, New York)

Development of the Latest Type Pitcairn Autogiro—Agnew E. Larsen, Pitcairn Autogiro Corp.
Stability of Helicopters—(Including Demonstration)—Arthur M. Young
Recent Air Corps Developments in Rotating Wing Aircraft—H. F. Gregory, U.S. Army Air Corps, Wright Field
Development of the VS-300 Helicopter—Igor I. Sikorsky, Vought-Sikorsky Aircraft, United Aircraft Corp.

5:00 p.m.

Annual Business Meeting

Reports of Officers and Election of Council Members

8:00 p.m. **Physiological Problems**

Chairman:
Arnold D. Tuttle, United Air Lines Transport Corp.
Acting Chairman:
Ross A. McFarland, Harvard University

Requirements of Military Oxygen Supply Apparatus—J. R. Poppen, Bureau of Aeronautics, Navy Department
Recent Trends in Army Aviation Medicine—O. O. Benson, U.S. Army Aero Medical Research Laboratory, Wright Field
The Use of Liquid Oxygen for High Altitude Flying—John D. Akerman, University of Minnesota
High Altitude Flying: Prevention of Anoxemia and Aeroembolism—Walter M. Boothby and W. Randolph Lovelace, II, Mayo Clinic

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Thursday **January 30**

9:15 a.m. **Structures**

Chairman:
John E. Younger, University of Maryland

Stainless Steel Control Surfaces—G. G. Cudhea, Fleetwings, Inc.
Proportioning of Aircraft Frameworks—Nicholas J. Hoff, Polytechnic Institute of Brooklyn
Least Work Solutions of Shear Lag Problems—Eric Reissner, Massachusetts Institute of Technology
Design of Incomplete Tension Field Beams—E. Robert Reff, Curtiss Aeroplane Div., Curtiss-Wright Corp.
General Instability of Cylindrical Structures—Louis Dunn, California Institute of Technology

12:30 p.m. **Luncheon**

Columbia University Men's Faculty Club

2.00 p.m.

Organic and Synthetic Materials

Chairman:
William C. Geer, Research Chemist

Natural and Synthetic Rubbers—(Including Demonstration)—James W. Schade, B. F. Goodrich Company
Specific Applications of Vulcanized and Rubber-Like Materials in Airplane Construction—Charles J. Cleary, U.S. Army Air Corps, Wright Field
Aircraft Plywood and Adhesives—Thomas D. Perry, The Resinous Products and Chemical Company

2:00 p.m. **Power Plants**

Chairman:
C. Fayette Taylor, Massachusetts Institute of Technology

Light Aircraft Engines—Harold Morehouse, Lycoming Div., Aviation Manufacturing Corp.
Development Problems of Light Aircraft Engines—Carl T. Doman, Air Cooled Motors Corp.
Possibilities of the Two-Stroke Cycle for Small Aircraft Engines—A. R. Rogowski, Massachusetts Institute of Technology

8:00 p.m. **Air Transport**

Chairman:
J. Parker Van Zandt, Civil Aeronautics Board

Short-Haul Air Transportation—C. Bedell Monro, Pennsylvania-Central Airlines Corporation
Economic and Technical Aspects of Air Carrier Regulations—Robert J. Smith, Braniff Airways
The Place of the Air Transport Industry in the National Defense—T. B. Wilson, Transcontinental and Western Air, Inc.
Evaluation of Cargo Plane Design Variables—Adolph Burstein, Stinson Aircraft Div., Vultee Aircraft, Inc.

Friday **January 31**

9:15 a.m. **Airplane Design**

Chairman:
William H. Miller, Bureau of Aeronautics, Navy Department

Air-Cooled versus Liquid-Cooled Aircraft—John G. Lee, United Aircraft Corporation
Some Aspects of Flying Boat Design and Possibilities—Michael Watter, Aircraft Div., Edward G. Budd Manufacturing Corp.
An Approach to the Flutter Problem through Laboratory Tests—Charles B. Lyman, Bureau of Aeronautics, Navy Department
Propeller Design Problems of High Speed Airplanes—H. B. Dickinson, Lockheed Aircraft Corporation
Mass Balancing of Airplane Control Surfaces—H. Katz, U.S. Naval Aircraft Factory

9:15 a.m. **Meteorology**

Chairman:
Athelstan F. Spilhaus, New York University

The Mount Washington Icing Research Program—D. L. Arenberg, Blue Hill Meteorological Observatory, Harvard University, and Patrick J. Harney, U.S. Weather Bureau
On the Technique of Forecasting Low Ceilings and Fogs—J. J. George, Eastern Air Lines, Inc.
Further Comparisons of Meteorological Soundings by Radio Waves with Radiosonde Data—Albert W. Friend, Harvard University
The Effect of Shear on the Propagation of Waves in the Westerlies—N. Garstens, Massachusetts Institute of Technology
Dynamical Approach to Isentropic Analysis—R. B. Montgomery and Athelstan F. Spilhaus, New York University

12:30 p.m. **Luncheon**

Columbia University Men's Faculty Club

1:45 p.m. **Aerodynamics**

Chairman:
W. Bailey Oswald, Douglas Aircraft Company

Factors Affecting Longitudinal Control Forces—George S. Trimble, Jr., The Glenn L. Martin Company
Directional Stability and Vertical Surface Stalling—George Schairer, Boeing Aircraft Company
Flutter Experiments and Applications of Theory—William Bollay and C. D. Brown, Harvard University
Compressibility Effects in Aerodynamics—Th. von Kármán, California Instituteof Technology
Flutter of Wing Sections—(Including Demonstration)—Maurice A. Biot, California Institute of Technology

valve particularly suitable for firewall or bulkhead installation, to permit quick removal of engines. By its use, pipe or hose lines containing fluid can be disconnected without loss of fluid or pressure from either half. *Commercial Aviation*, November 1940, pages 64, 66, 68, 8 illus.

Radio Controlled Seadrome Lights Make Landing "Fields" of Harbours and Lakes. Fluorescent lights mounted on floating rubber doughnuts and controlled by short wave radio are shown and described. Developed for use as marker beacons for seaplane or flying boat landing lanes, the new lights make possible night landing facilities for practically every seaplane base. *Commercial Aviation*, November 1940, pages 44, 50, 1 illus.

Model Airplanes

Tricks in Covering. H. A. Thomas. A lesson in pictures on how to apply paper, silk and plank, surfaces to the fuselages and airfoils of model airplanes. *Air Trails*, January 1940, page 25, 19 illus.

Goods' Championship Radio Model. Bill and Walter Good. The third in a series on radio controlled model airplanes. The article explains the technique of self-instruction in flying the miniature radio controlled aircraft. First the airplane must be flown without the radio to determine the characteristics of the craft. Then the radio must be installed. The article explains what the remote control pilot must learn and outlines exercises for him. *Air Trails*, pages 26, 27, 58–60, 7 illus.

So-Long. Bill Englehardt. A description and the plans of the winner of the Class B Open Title and the 1940 National Gas Model Meet, the So-Long. This model brought its builder the coveted Gar Wood Trophy. *Air Trails*, January 1940, pages 28–30, 44, 10 illus.

Curtiss P-40. Bill Gogh, Jr. A description and constructional directions of a flying scale model of the Curtiss P-40, with half-scale plans for the airplane. *Air Trails*, January 1941, pages 36–39, 44, 6 illus.

Wing Spreader. Roger Hammer. Plans and directions for constructing a unique catapult glider. This all-balsa glider is catapulted from a rubber sling. The wings are hinged, and remain folded back during launching, and are snapped into place when the craft begins to glide by a carefully adjusted set of rubber bands, controlled by drag fins on the wingtips. *Air Trails*, January 1941, pages 40, 41, 64, 5 illus.

Facts about Balsa. George Ross. Balsa wood is a familiar material to all airplane model builders. This article gives the physical characteristics of this wood, explaining some of the less known facts about it. *Air Trails*, January 1941, pages 31, 49, 2 illus.

The Gas "Champ." Russell Simmons. Plans and directions for building the gasoline model which won first place at the Eastern States Model Airplane Meet at Hadley Field. *Model Airplane News*, December 1940, pages 12–16, 62, 63, 9 illus.

A World Record Autogiro. Richard Obarski. Directions and plans for building a duplicate of the rubber band powered autogiro which broke the world's indoor record with a flight of 2 minutes 26.5 seconds. *Model Airplane News*, December 1940, pages 20–22, 57, 58, 60.

Building the Potez Twin. Robert V. Smith. How to build this unusual type of flying scale model. The article includes complete diagrams and directions for construction. *Model Airplane News*, December 1940, pages 26–31, 38, 40, 8 illus.

Naval Aviation

Future Naval War. Lieutenant Franklin G. Percival, U.S.N. (Ret.). An analysis of future naval design and tactics, based upon the possibility of a two-ocean war, and upon the many new factors introduced by the more extended use of military and naval aircraft. The writer believes that aircraft which can be used to force the enemy to turn and fight greatly lessen the present emphasis on warship speed. He stresses the need for anti-aircraft protection and predicts that future warships will have to carry 7 to 14 times the anti-aircraft ammunition formerly allowed. Problems of defense against possibly superior forces in both oceans plus the need for greater protection against air attack call for consideration of added defensive armor, added fire power, more ammunition at a sacrifice of excessive speed. Value of the latter, in the writer's estimation, is open to question. *U.S. Naval Institute Proceedings*, pages 1699–1712.

Navigation

Die Lambertsche Karte als Luftnavigationskarte. (The Lambert Projection as an Aeronautical Chart.) J. B. Grambow. During the last decades tests have been made using the Lambert conformal conic projection in place of the Mercator projection for aeronautical charts. The general reason for this change is the claim that distortion with the Lambert projection, is not as pronounced as with the Mercator projection. Investigations as to what degree the Lambert projection complies with the requirements of the navigator have not been made as yet. This study is intended to fill this gap. The writer concludes that for navigation requirements, the Mercator projection is more accurate than the Lambert projection. *Luftfahrtforschung*, September 20, 1940, pages 281–290, 15 illus.

Your "Loop"—What It Will Do for You. Sidney Nesbitt. Another in a series by this writer on radio for the private flyer. The article deals with the loop type direction finder and its uses. To function well, the set must be properly installed. How to use the loop, how to overcome 180-degree ambiguity and how to work a triangulation problem in navigation are given with important hints on what the loop will and will not do. *Air Facts*, November 1940, pages 16–20, 50, 2 illus.

Parachutes

The "Pincer Movement" from the Air. Story of the development of parachute troops by Germany, with an outline of training methods and routine. Details of equipment, choosing of recruits and tactical use are shown and described. *The Aeroplane*, October 25, 1940, pages 457–459, 14 illus.

Bailing Out. Gwynne Johns. First hand suggestions on how to make a parachute jump. A time count for delayed jumps is given and sensations in the various stages of the jump described. *The Aeroplane*, November 1, 1940, pages 493, 494, 2 illus.

Rigger on Wheels. Sandal Dailey. Most flying schools engaged in training students in the Civilian Pilot Training Program find it difficult to send away their parachutes for packing, due to the constant demand on the equipment. Frank Wilson, parachute rigger, has started a service for such schools by a portable parachute service which is carried in a truck. How he covers his 3,000-mile servicing route and what this unique service offers are described. *Southern Flight*, November 1940, pages 11, 14, 1 illus.

"Three of Our Pilots Saved"—Cost: $900. Percy T. Cole. An account of Canadian manufacture of parachutes, including figures and details about materials, fabrication and testing. *Commercial Aviation*, November 1940, pages 26, 27, 2 illus.

Personalities

I Learned About Flying From That! Paul Gustine. A veteran pilot relates his adventures trying to outsmart the weather experts. In the days before strict dispatching on the air lines the writer tells of taking off against the meteorologist's advice. As a result

he flew through a wind shift and met snow in August. *Flying and Popular Aviation*, December 1940, pages 41, 42, 60, 1 illus.

Zehn Jahre Ju-52. (**Ten Years of Ju-52.**) Ten years ago the Ju-52 made its first flight. Here are some notes on the career of its creator, Dipl.-Ing. Ernst Zindel, chief designer of the Junkers Works. He has kept quietly and modestly in the background, and yet is one of the outstanding designers of the German airplane industry. *Der Deutsche Sportiegfler*, October 1940, page 203, 1 illus.

Photography

Analytical Graph Films in Aviation. Victor Shawe. A motion picture method for recording the landing speed and landing characteristics of an airplane. The landing aircraft is photographed upon sensitive, fine grained film. Vertical and horizontal graph lines are registered on the film through pre-exposure. The camera is set up at a given distance from the line of flight and its speed kept constant by a synchronous motor or checked by photographing a stop watch. Details of equipment and the method used in this particular experiment are given together with an analysis of results. *Aero Digest*, December 1940, pages 112, 113, 166, 5 illus.

Air Corps Photographic Observer. A special set of test flight recording instruments mounted before a motion picture camera is soon to replace the notebook strapped to the test pilot's knee. Control of the new device is simplified, requiring only the pressure of a trigger to record readings of all instruments simultaneously. Details of construction and use are given. *Air Corps News Letter*, November 1, 1940, pages 3, 4.

Private Flying

"Dear Editor—." Robert F. Davis. A patent attorney writes about his nation-wide practice, and how the use of his own airplane makes even a wider clientele possible. This article also includes an account of several of his trips. *Southern Flight*, November 1940, pages 10, 14, 1 illus.

To Panama and Back by Rearwin. Dr. Travis E. Kallenbach. First of two articles about a six-week solo vacation flight of 10,000 miles through Central America and return. An account of careful and thorough preparation and the different legs of the trip south to El Salvadore. *The Sportsman Pilot*, November 15, 1940, pages 14, 15, 36, 38, 40, 3 illus.

Country Club Cruise. Account of an annual autumn tour by California private flier members of the various aviation country clubs to Del Monte. First prize of a navigation contest was won by Charles J. Correll, the "Andy" of "Amos 'n Andy." *Western Flying*, November 1940, pages 54, 55, 7 illus.

Once to Every Man. Devon Francis. The Aviation Editor of the Associated Press takes his wife and dog out on his first long cross-country flight. An account of their experiences on a flight from New York to Wichita and back. *Air Facts*, November 1940, pages 10–15.

Flivvers and the Future. W. B. Stout. Outline of some of the problems to be solved in order to realize the full potentialities of mass markets and mass production which the widespread adoption of private flying would provide. *Commercial Aviation*, November 1940, pages 21, 48, 2 illus.

Air Camping Is Sport? Wolfgang Langwiesche. Camping out with a light airplane is a new kind of inexpensive touring, which is fast gaining popularity. How to do it safely, comfortably and inexpensively is described. Suggestions are made such as staking the plane down for the night with insulated wire instead of rope to avoid shrinkage, using a blanket over the horizontal stabilizer as a windbreak, and using sacks filled with sand as anchors on a beach. The technique of landing on a farmer's field and setting up camp without making enemies is part of a discussion on etiquette for the air camper. *Flying and Popular Aviation*, December 1940, pages 14–16, 66, 6 illus.

Brass Tacks. The facts which the Committee on Aviation of the Actuarial Society of America has gathered from official sources and from the files of insurance companies, show interesting figures on the actual risks in private flying. A student taking dual instruction was revealed to be taking only average risk; sightseeing flights are 40 per cent below the normal risk level, while competitive flying, such as in air races, is 36 times as risky as average transportation.

The article points out many errors which the statisticians have made, chiefly through lack of acquaintance with private flying. For instance, the Committee states that a pilot incurs five times the risk at 250 hours that he did at fifty. Apparently it fails to take into consideration that during the pilot's first fifty hours of flying, he is more apt to have an accident, due to inexperience or poor judgment, than any other time during his flying career. *Air Facts*, November 1940, pages 3–9.

Production

Along the Air Frontier—Observations on Aerial Defense. C. B. Allen. Comment on the need for accurate information about airplane and defense production. It is stated that if we are to avoid bitter disillusion, accurate figures and estimates by qualified technicians must be substituted for the roseate promises of politicians. The writer discusses the difference between airplanes on order and on delivery, comparing the statements of Lord Beaverbrook and Henry Morganthau, Jr., predicting 3,000 airplanes per month for Britain, to that of William S. Knudsen who estimated that total United States aircraft production would not reach 3,000 airplanes per month until the middle of 1942. Furthermore, Mr. Knudsen backed his estimate with production figures indicating that the British would have to build thirty-eight new aircraft factories in the United States in order to get 3,000 warplanes per month. This wide discrepancy between American promise and performance, as exemplified by 3,000 airplanes a month promised and 300 shipped, is shown to be a defense problem for the United States as well as Great Britain. *Preprint, Western Flying*, December 1940.

Propellers

Variable Pitch Propeller Principles Explained. Assen Jordanoff. Purpose and principles of the variable pitch propeller are discussed in terms of the gear shift on an automobile. Electric and hydraulic control mechanisms are explained and the differences in horsepower, speed and performance due to changing propeller pitch are given. *Canadian Aviation*, November 1940, pages 47, 48, 50, 6 illus.

Electric Airscrews and Blade "Cuffs." Survey of developments in the field of electrically controlled propellers. The British Rotol Electric Airscrew, the Curtiss Electric full feathering and other propellers are described together with blade "cuffs" or fairings at the blade roots, which are said to reduce cylinder temperatures and give added thrust for take-off for planes equipped with radial engines. Research into lighter and stronger materials for propellers is also described. *The Aeroplane*, October 25, 1940, pages 462–464, 10 illus.

Electric Airscrews. Details of the electrically controlled propeller developed by Rotol Airscrews, Ltd. Pitch is fully adjustable to feathering, and it can be operated at constant speed, manually controlled, or at fixed pitch. De-icing equipment of the fluid type is provided. *Aeronautics*, November 1940, page 63.

Solving the Propeller Problem. Expansion story of the Hamilton Standard Propellers division of the United Aircraft Corporation, to meet the

needs of increased aircraft production. Included is a description of the process of machining and finishing propeller blades, hubs and hub mechanism. *Western Flying*, November 1940, pages 31–33, 45, 8 illus.

Modern Bench Testing Equipment for Airscrews. Description of testing apparatus and methods used by Rotol Airscrews, Ltd. The testing room is large enough to accommodate any size of propeller likely to be produced for some years to come. A cable-suspended nacelle is provided with a universal mounting plate to take any air cooled or liquid cooled engine up to 3,000 hp. The control room is insulated, and a mirror permits observation of blade tips for flutter. Horizontal thrust is taken by three steel links and a motor-operated adjustable thrust block containing fluid under pressure, connected with a statimeter through which the pull of the propeller is read. It is stated this is a new application of the statimeter. Straingage tests are made by cementing small strain-sensitive elements along each blade and connecting them through slip-rings to an amplifier and recording oscillograph. *Aircraft Production*, November 1940, pages 362, 363, 2 illus.

Radio

Simplified Radio Orientation Training. Robert A. Buss. A new device called the Orientator has been designed to simulate any radio orientation problem which may be encountered in flight. It enables the student to cultivate automatic response to any radio signal or combination of signals, so that he is eventually able to combine radio and instruments without confusion. Details of its development and operation are given. *Aero Digest*, December 1940, page 56, 1 illus.

Radiovagornas Utbreding och Fadingfenomenet. (Propagation and Fading Phenomena of Radio Waves.) Gustav Norsen. This treatise goes into details on the generating and reception of radio waves. Subjects included are radiation and its characteristics, propagation and reflection of radio waves, ionization, wave reflection and its range, Heaviside layer, interference, fading, refraction, night effect, airplane effect and the Adcock antenna. *Flygning*, September 1940, pages I–III, 4 illus.

Pilotless Planes. Allan Finn. The radio controlled pilotless airplane was originally developed as a practice target for anti-aircraft gunners. Every major air power has done some work with this general idea. The success with which British airplanes have been flown by radio remote control in flights of over 200 miles from its transmitter control makes air raids on enemy bases by pilotless aircraft a definite possibility. This article outlines the history of the development of radio controlled airplanes in England and in the United States, and predicts some of the uses to which they may be put in the future. *Air Trails*, January 1941, pages 12, 13, 52, 53, 6 illus.

Mayor Fiorello H. LaGuardia of New York presents the Frank M. Hawks Memorial Trophy, for an outstanding contribution to aircraft radio, to William P. Lear for his work in the development of the gyromatic navigator.

New Development Trends in Airway Radio Aids. Henry W. Roberts. Review of trends to ultra-high frequency equipment in aircraft and airway radio. Projects of the Radio Development Section of the Civil Aeronautics Board are examined. Included are ground direction finders, omnidirectional radio beacons, UHF radio ranges, two-course UHF ranges, FM for radio ranges, the CAB-RTCA instrument landing system, the CAB-MIT microwave instrument landing system, UFH traffic control and FM for airport traffic control, *Aero Digest*, December 1940, pages 50, 52, 191, 3 illus.

Stress Analysis

New Methods of Calculation for the Determination of a Special Form of Instability of the Elastic Equilibrium of a Cantilever Wing. Tullio Viola. The superposition of the flexural instability of the plane form of a cantilever wing in its own plane, over that of the torsional elastic equilibrium, gives rise to a special phenomenon of mixed instability. The latter has been translated analytically by Professor C. Minelli into the problem of determining the first positive characteristic value of a certain system of two ordinary linear and homogeneous equations in two unknown functions, with given limiting conditions. Methods of calculation, both analytical and numerical, for the solution of this problem are described. Results confirm intuitive inferences that other conditions being equal the backward displacement of the elastic axis lowers the critical speed. *The Journal of the Royal Aeronautical Society*, November 1940, pages 816–826, 3 illus.

Plane Braced Frames Loaded Perpendicularly to Their Planes. Jean Drymael. Method of calculation of plane frames, each bar of which is able to withstand flexion perpendicularly to the main plane. Having shown that the stress of loads parallel to that plane is independent of perpendicular load stress, the writer develops for the latter a method of resolution based on Cross's principle. Fictitious supports are added to each knot and then successively removed, until the structure reaches the true form corresponding to the loading. An important improvement of the original method—formerly not applied to three-dimensional construction—consists in the use of adjustments, that is, appropriate movements of parts of the structure as a whole. *The Journal of the Royal Aeronautical Society*, November 1940, pages 827–843, 12 illus.

Some Experiments on the Forced Vibration of Varying Period. Katsutada Sezawa and Wataru Watanabe. Report of experiments showing the resonance condition of an elastic bar

under forces with frequency increasing or decreasing linearly with time. The vibration of the bar was obtained electromagnetically, the intensity of excitation being constant for every vibration and throughout the range of varying frequency, and also for any set of experiments. A magnetic damper was added to the bar to ascertain the effect of viscous damping on resonance amplitudes at varying frequencies. Results of the experiments are discussed. *Report of the Aeronautical Research Institute, Tokyo Imperial University*, August 1940, No. 195 (English translation).

Grunddragen av nagra Metoder for berakning av Belastningsfordelningen langs en Vinge. (Basic Problems of Some Calculation Methods on Stress Distribution along the Wing.) S. E. Gudmundson. A review of various methods for the calculation of stress distribution along the wing. It is stated that while some of these methods are only of theoretical interest, others are applied generally in airplane design and stress analysis. *Flygning*, September 1940, No. 17B, pages I–IV; No. 18B, pages IV–VI.

Considerazioni sull'impiego dei normali apparechi da bombardamento nelle azioni in pichiata. (Considerations on the Use of Regular Bombing Planes for Dive Bombing.) Dr. Giorgio Salvadori. Simplified formula on the maximum stress which the airplane is able to withstand during the pull-out of a dive provided that such a dive does not subject the structure to stresses which are greater than the load factor. A coefficient, called "degree of righting," indicates the capacity of the wing unit to support the abrupt pull-out of a dive. *Rivista Aeronautica*, September 1940, pages 427–431.

Dynamic Stability of a Column under Periodic Longitudinal Forces. Ikuo Utida and Katsutada Sezawa. Mathematical and experimental examination of the vibrational condition of a column under periodic longitudinal forces. Results show that dynamically the problem is one of instability in free transverse oscillation as well as of resonance in forced longitudinal vibration.

Although there are a number of frequencies at which vibration becomes unstable or resonance-like, a fundamental vibration pattern for the column is usually found which in turn is excited by the periodic forces of different frequencies. Ratios of the natural frequency to that of the exiting forces are 1/2, 2/2, 3/2, 4/2, 5/2 and so on. The greater the ratio, the smaller the resonance amplitude and range of instability.

The effects of increasing or decreasing frequency on changes of amplitude are discussed together with wave forms at various resonances. Several structural members of an airplane are subject to periodic longitudinal forces, and this paper is a preliminary to further study of vibration of aircraft parts. *Report of the Aeronautical Research Institute, Tokyo Imperial University*, August 1940, No. 193 (English translation).

Testing

Proof Testing of Large Wings. K. R. Jackman. Consolidated Aircraft Corporation has substituted a hydraulic proof loading device for sand or shotbag test loading methods used heretofore. The new method is especially applicable to proof loading large tapered wings in that it allows wing tip deflections of sixty inches. The wing is supported above the floor by a steel sub-structure. Rubber-covered wooden formers are clamped across the wing at wing bulkhead locations and cables are so arranged that the proper amount of load tension can be exerted at the proper points. Load is applied to these cables by means of hydraulic rams. Test of a wing with a 100-foot span is shown. *Aero Digest*, December 1940, pages 120, 123, 124, 9 illus.

Arctic-Testing the Big Bombers. Projects and problems confronting the Army Air Corps at its new test station at Fairbanks, Alaska. Research to enable the Air Corps to operate efficiently in Arctic regions will be conducted to improve de-icing equipment, protect engines and structures against cold and test types of landing gear such as skiis and tires with better traction in snow. *Popular Mechanics*, January 1941, pages 88, 89, 131A, 6 illus.

Warfare

The Aerial Seige of London. Leonard Engel. For the first time in history, air power has been called on to defend the heart of the British Empire. A comparison of the relative advantages at which the attacker and the defender operate is presented, together with a discussion of the tactics and equipment used. According to the writer, the Luftwaffe *must* destroy the Royal Air Force, if Germany ever hopes to end the war in her favor. The German air force started the war with between 15,000 and 17,000 airplanes, against Britain's 6,000 to 7,000. Britain's pilots average six combat missions a week. In some cases they have contacted the enemy a dozen times a day. Germany hopes that her superior number of pilots will eventually cause physical breakdown of the R.A.F. pilots from fatigue. *Flying and Popular Aviation*, December 1940, pages 13, 52, 54, 3 illus.

Blitzkrieg—The Diary of a British Staff Officer. Major Philip Gribble. An hour-to-hour account of developments in the German invasion of Holland, Belgium and France. It mirrors the grim efficiency of the coordination between the German Air Force and the Panzer divisions, and the tragedy of a once magnificent French Army whose will to resist was so quickly shattered.

It would be impossible for the writer to keep personal feeling out of his entries, especially under the strain of such a crisis in which so much was obviously so wrong.

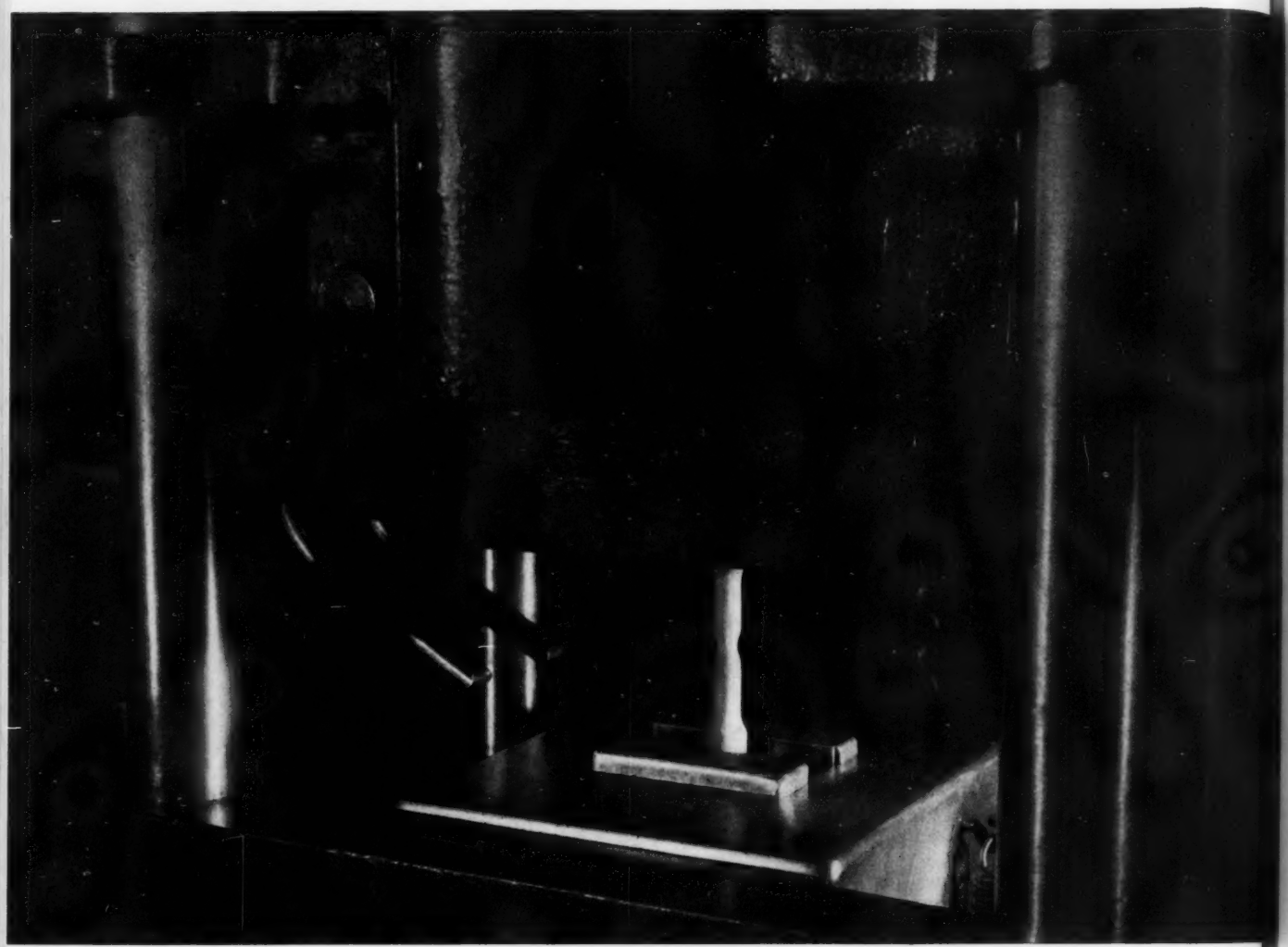
He states that 500 fighters operating against the dive-bombers could have saved Sedan. Subsequent British fighter effectiveness against Junkers dive-bombers supports this belief. Yet the decisions on how and where the R.A.F. would operate were so slow in coming that the opportunity for effective counter-action was lost again and again. The day fighters were needed at Sedan, British bombers were ordered to attack freight yards at Essen and Hamm, miles to the rear, in Germany. Such delay is compared to the simple effectiveness of a German order by radio, and its execution. Intercepted, it read, "All fighters to Arras." Ten minutes later came the reply, "All fighters on the way."

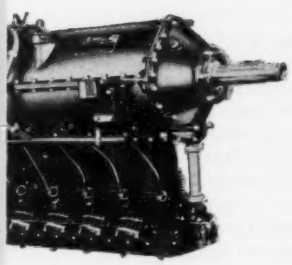
Crucial stages in the Allied defeat are recorded as they developed and were reported to the Advanced Headquarters of the British Air Forces. Its evacuation and transfer to England is described in the final entry. *Saturday Evening Post*, December 7, 1940, pages 9–11, 133, 134, 136, 4 illus.; December 14, 1940, pages 20, 21, 84–89, 3 illus.

The War of Attrition. Cy Caldwell. The War has become a grinding-down process of destruction by air bombardment. War industries and the civilians who man them are bearing the brunt of bomber attack. This war of attrition was not in the original German plan, which was to have been aerial blitzkrieg followed by invasion. Changes in the war pattern caused by Britain's air defense are outlined, including recent developments in Albania and the surprising absence of large scale operations by the Italian Air Force on that front. *Aero Digest*, December 1940, pages 36–38, 116, 6 illus.

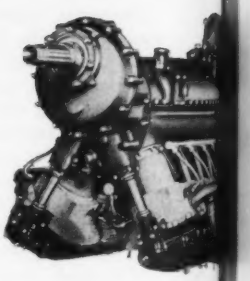
The Example of London. Editorial comment on the adaptability of people to air bombardment. *The Aeroplane*, October 25, 1940, pages 445, 446.

We know only one way to make a good engine





And that is by mixing the sweat of our brows with the micrometric precision of our instruments. We must be completely satisfied that every part —every last stud used in making a Ranger engine—represents the highest possible achievement of modern science and technology. Typical of that never-ending operation is the routine tensile strength testing applied to sample "coupons" of all Ranger engine castings. With Ranger there can be no compromise with quality.



RANGER AIRCRAFT ENGINES

Farmingdale, Long Island, New York

DIVISION OF FAIRCHILD ENGINE & AIRPLANE CORPORATION

House Organs and Catalogues

Air Transport in New Guinea

"Jungle Gold." The history of Guinea Airways Ltd. is bound up with the development of tremendously rich gold bearing areas in Northeast New Guinea. Its freight transports have flown eight giant dredges piece by piece over mountains and jungles to a landing field 7,500 feet above sea level. Guinea Airways Ltd. was organized for the purpose of transporting men and modern machinery over a thirty-five mile route which heretofore had been a ten-day trip through savage infested jungle. While it began as one of the world's shortest airlines, up to September 1939 it had carried 58,135 tons of freight and 82,007 passengers in its New Guinea operations. It is still the only means of transport over that short stretch of mountains and jungle. Details of further development in large scale placer mining made possible by its air freight service and subsequent growth of the airline are described. *The Intavia World*, October.

Line-Production Foundry

Description of steps in the process of casting aluminum cylinder heads for Wright Cyclone engines. Wright *Trade Winds*, November.

The 5000th Cub

Largest Production of One Plane. W. T. Piper of the Piper Aircraft Corp. of Lock Haven, Pennsylvania, claims two world's production records simultaneously. The 5,000th Cub Trainer is said to total the greatest number of one type ever produced. In addition, Piper has reached a production rate of 100 airplanes a week, also claimed as a world's record. It is stated that November's production will reach 125 planes, and the rate will be stepped up to 10,000 airplanes a year from the recently expanded factory. *The Cub Flier*, November.

Bombing Objectives

R.A.F. Targets in Germany. F. Buckley Hargreaves. Description of a map and thirty-page list of dates and objectives of seven hundred bombing raids over Germany issued by the Ministry of Information. *London Calling*, November 16th.

Parks Training Program

Parks Establishes Training Centers. Four thousand Army Air Corps cadets will receive primary training in 1941 through Parks Air College and three additional training centers now being operated under the supervision of the College. The latter include the Missouri Institute of Aeronautics at Sikeston, the Mississippi Institute at Aeronautics at Jackson and the Alabama Institute of Aeronautics at Tuscaloosa. *Parks Air News*, November.

Aircraft Finishing

The Engineering Finish Group at Lockheed. Wartime operations frequently require storage of airplanes outdoors, or in other ways expose them to the weather or to salt water. This necessitates special care in the finishing of surfaces and special protection for exteriors of the airplane's fittings, and vital parts. Lockheed has assembled a group of specialists to engineer the finishing of their products, to render them as nearly weather-proof as possible. A member of this group explains in simple language the problem of aircraft finishing. *The Lockheed Aircraftsman*, November.

Copper Weights and Data

A new weights and data handbook of copper, brass and bronze products which gives direct weights on standard copper and brass alloys with conversion tables to determine weights, temperatures, linear or surface measurements in any standard form. Revere Copper and Brass Incorporated, *Revere Weights and Data Handbook, Third Edition.*

U.A.L. Offers Scholarships

W. A. Patterson of United Air Lines announces the twelfth annual offering of four United Air Lines Scholarships, consisting of a non-flying course at the Boeing School of Aeronautics, ten hours of Link Trainer instruction and ten hours of dual instruction and solo flying. The scholarship student who shows the greatest aptitude for flying will receive a complete airline pilot's course. The article outlines the conditions of the scholarships and names the judging committee. *Boeing School News*, November.

Cables and Terminals

All the types and sizes of aircraft cables, cable terminals and miscellaneous cable products used in aircraft production and maintenance, manufactured by the Aircraft Department of the American Chain and Cable Co. are described and their specifications listed. The tests for fatigue, tensile strength and resistance to corrosion are outlined. Information on the stretching of cables and tables on factors of stretch are provided, with useful recommendations on the diameter of sheaves and some useful "don'ts" on cable splicing. American Chain and Cable Company *Cables and Cable Terminals for Aircraft.*

Hydraulic Selector Valve

After three years of development, Fleetwings offers a new hydraulic selector valve, designed to operate retractable landing gear systems, wing and cowl flaps or other parts of aircraft requiring intermittent operation in two directions. Outstanding feature is its centering spring and electric releasing mechanism which returns the valve to a neutral position after any desired function is completed. This allows unrestricted flow of the circulating fluid. Fleetwings, Inc.

Lycoming for Streamlining

The Lycoming O-1230-D. Description and specifications of a 1,200 hp. horizontally-opposed, twelve-cylinder, liquid-cooled engine. The narrow, horizontal frontal area makes it adaptable for improved streamlining into the wing. *The Intavia World*, October.

Executive Training

Executive Subjects Prepare Parks Students for the Business of Aviation. Outline of the curriculum for business and executive training in aviation, offered by Parks Air College. Requiring 96 weeks for its completion, the course includes 3,000 hours of the technical side of aviation and 704 hours of aviation business subjects such as sales, advertising, accounting and finance, business law, economics, public speaking and commercial geography. *Parks Air News*, December.

Elastic Stop Nuts

For fastening sheet-metal assemblies in which the parts must be readily removed and returned to position, a clinch type of self-locking nut with knurled shank is offered by Elastic Stop Nut Corporation.

To install the nut, a hole is drilled in the structure and the shank is pressed into the hole. The mouth of the shank is then spread against the back of the structure to effect a clinching hold. The knurling engages the drilled surface and thus assists in eliminating any turning of the nut.

The head of the nut is fitted with the vulcanized fiber collar which characterizes all types of Elastic Stop Nuts. This collar, being unthreaded, resists the entrance of the screw, thus automatically taking up all thread play and bringing the load-carrying thread faces of nut and screw into a tight pressure-contact. As the screw thread impresses its way through the collar, this pressure is maintained and increased to such a degree that the screw cannot work loose, even under the most severe vibration. Because of the resilient character of the fiber collar, the screw may be removed and replaced repeatedly without loss of the locking action. Elastic Stop Nut Corporation, Union, N. J.

British Bomber Activity

Why the R.A.F. Is Interested in Hamm. More than sixty-five bombing raids have been made by the British on the railroad yards at Hamm. It is explained that Hamm is one of the nerve centers of German rail transportation. Its freight yards for switching and assembly of freight trains is four miles long and a mile wide. Traffic delay and disruption is the objective of British bomber squadrons. How this is done at the various feeder points in the yard itself, is outlined. *London Calling*, November 9th.

Stepped-Up Engine Production

Wasps and Hornets by the Thousand. Pratt & Whitney, upon completion of present expansion program, will be producing single-row and twin-row high-powered radial engines at eight times their output of eighteen months ago. How this increase was effected smoothly in such a short space of time is described. Important contributing factors were (1) orderly plant expansion planned far ahead of time, (2) shortage of skilled labor forestalled by a training program begun three years ago and (3) policy of developing subcontractors to handle nearly 50 percent of total production labor. The latter supply forgings, castings, accessories and parts. *Douglas Airview*, October.

Celestial Navigation for the Army

Flying Classrooms. Three of the older Pan American flying boats have been converted into flying classrooms, in which Army Air Corps cadets are being given Pan American's course in aerial navigation. The curriculum of the course is given. Pan American Airways *New Horizons*, November.

Under War Pressure

Design Progress in Time of War. An analysis of problems in military aircraft design by the chief designer of the de Havilland Aircraft Company, Ltd. Following a comparison of peace-time and war-time design objectives, typical problems in design of root, hub and spinners for high-speed military airplane propellers are explained. Also included is a discussion of materials, fuels and research activities in aerodynamics and engines. *The Intavia World*, October.

The world's largest airplane tire and wheel assembly, built by Firestone and Bendix for the Douglas B-19 bomber, is 96 inches high and weighs 2,700 pounds.

Gages and Ammeters

A catalogue describing new types of oil temperature gages, vane and moving coil type ammeters and pressure gages, produced by *Air Safe Aircraft Instruments.*

Auto Plants Build Airplane Parts

The automobile industry, acting in cooperation with the National Defense Commission, has already taken over part of the work of producing airplane engines. Now they are about to undertake the more complicated job of building in quantity, parts of airplane structures for assembly in aircraft plants, under the supervision of aeronautical experts. The adjustments in the automotive industry, such as delaying changes in 1942 models of pleasure cars, are outlined. *Automobile Facts*, November.

Balloon Barrage in Action

A Junkers for Supper. Member of a balloon barrage crew describes what happens when a raiding Junkers hits the cable of a barrage balloon. *London Calling*, November 16th.

New Engine Starters

The New Eclipse Engine Starters. Descriptions of the Series 40 and 41 hand, or combination hand-and-electric starters for engines of 1,500 to 1,800 hp., the new type E-160 with an integrally-mounted hydraulic feathering pump, and the type 635 direct-cranking electric starter for engines up to 100 hp. *The Intavia World*, October.

Visit to a Bombing Squadron H.Q.

Operations Room. Description of nightly activity in the operations room of a Royal Air Force bombing squadron. The manner in which flight orders come in, how they are received and interpreted and what happens between the time orders arrive and the airplanes take off on their missions, is given in detail. The atmosphere of the room is recreated, even to the introduction of some of the new aeronautical colloquialisms coming into use, such as "Ops" for the operations room and "Met" for the meteorological officer. *London Calling*, November 22nd.

Early History of Argus Engines

Aus unserer Werkgeschichte vom Bau der ersten Argus Flugmotoren im Jahre 1909 bis zum Beginn des Weltkrieges. (*From the History of Our Factory, Beginning with the Construction of the First Argus Aircraft Engines up to the Start of the World War.*) Notes on the evolution of the Argus aircraft engine. Although the dirigible "Ville de Paris" was equipped with Argus engines, these could not be called aircraft engines, as they were modified boat engines, clumsy and heavy. However in 1909, after the Wright Brothers had demonstrated their flying machine in Europe, the Argus Works decided to build aircraft engines. They utilized their experience gained in automobile engine construction, and designed a four-cylinder, 52 hp., liquid cooled inline engine. From it was developed a 72 hp. and a 100 hp. engine. The first six-cylinder engine was built in 1911, and afterward the 125 hp. six-cylinder engine was developed from the 100 hp. four-cylinder engine. At many flying meets, airplanes equipped with Argus engines were victorious. By the end of 1913 the German aircraft industry caught up with the French which had heretofore been in the lead. *Argus-Werkmitteilungen*, August.

(*Continued on page 47*)

From the Industry

Civil Aeronautics Administration

Completion of arrangements by which the Mayo Foundation, at the request of the Civil Aeronautics Administration, will conduct extensive research into the correlation between physical examinations of civilian airplane pilots and their actual performance in flight was announced today by Robert H. Hinckley, Assistant Secretary of Commerce.

The Mayo Foundation for Medical Education and Research, long interested in the medical problems of aviation and recently co-winner with the airlines of the Collier Trophy, will conduct the research as a public service and at its own expense, the only cost to the government being C.A.A. flight courses for several of the doctors conducting the studies, he explained.

Principal aim will be to develop more accurate yardsticks, in simplified and improved methods of physical examination, to predict on the ground the relative ability of pilots and prospective pilots.

Ten Mayo specialists in the various related fields—vision, hearing, heart, etc.—not only will study their student "guinea pigs" on the ground, but will follow them step by step through the flight courses in order to watch and measure the relation of actual performance to the medical forecasts.

Several of the Mayo medical men are flight surgeons trained at Pensacola and Randolph fields. Others, without flying experience, will take the C.A.A. Civilian Pilot Training courses along with the students they are studying, Dr. W. Randolph Lovelace, II, of the Foundation has informed the C.A.A.

The studies will be made primarily from a civilian point of view and may be the first step toward instituting in the field of aviation medicine schools for civilians comparable to the schools which the armed forces have had for some time, Mr. Hinckley indicated.

The C.A.A.'s far-flung Civilian Pilot Training Program, enlarged and altered last June to create a reservoir of citizen fliers on which the armed forces could draw for pilot material, already has fed more than 2600 of its trainees to Army and Navy air training centers, Jesse H. Jones, Secretary of Commerce, announced recently.

Secretary Jones said the figures have been compiled in a canvass of 571 commercial flight centers which participated in the training up to September. The number has been increased since September to more than 600 centers, but the 18,000 students now in training will not complete their civilian courses until February.

Army air schools have drawn 1935 of the civilian volunteer pilots and the Navy 701, the survey shows.

These figures include only those students who are now in military training or have been definitely accepted and are awaiting orders to report, Secretary Jones explained.

He said the flight centers reported an additional 677 who have applied for military aviation but have not yet been accepted, but that these were not included in the above totals.

Flight instructors from C.P.T. training schools also are providing an important reservoir of highly-trained manpower, the Secretary said, pointing out that 518 of them already have left the program to serve the armed forces or the airlines. Of these, 254 have been accepted by Army primary schools, 163 by the airlines, 63 by Canadian aviation schools and 38 have returned to active military duty. This, he explained, is more than 40 percent of the teaching force of 1200 in the civilian program.

"Don't ride with student pilots!!!," was the warning issued to the public recently by the Civil Aeronautics Board.

"First, accepting a ride from a student pilot is accepting one of the greatest risks still connected with aviation," a statement by the Board explained. "Last year, more than 40 per cent of the accidents in all civil aviation which resulted in fatalities to passengers occurred when a student pilot was at the controls.

"Second, in accepting a ride with a student pilot you will be helping that student to violate a Civil Air Regulation which has been established to protect you and the rest of the public against injury or death. Furthermore, even if you complete your flight in safety, you will be jeopardizing the whole flying career of the student with whom you fly, for you will expose that student to the certain penalty of having his certificate revoked. With so many fatalities resulting from the violation of this rule, the Civil Aeronautics Board would be derelict in its duty if it did not penalize every detected violator to the full extent of its powers. A few days ago the Board, exercising its quasi-judicial function, revoked the certificates of six student pilots for the violation of this rule. Henceforth, any student pilot found to have carried passengers, with or without pay, must expect to suffer a similar revocation of his pilot certificate.

"The inspection staff of the Administrator of Civil Aeronautics has assured us of its fullest cooperation. The Board is using every channel of approach to student pilots to warn them of the severity of its attitude. We hope that airport managers and aviation officials of all kinds will help us decrease this hazard by discouraging students from offering such illegal flights. But the public itself can help too by refusing such flights when they are offered. In case of doubt, ask to see the certificate of the pilot who has offered you a ride. If it says 'Student Pilot,' stay out of his plane!

"Conducted with proper discretion the flying done by a student pilot while training for his Private Pilot Certificate is not dangerous. But a student who offers an illegal ride isn't demonstrating proper discretion. He is trying to show off a new prowess he probably doesn't possess. An unfinished pilot in a show-off mood is a menace which the Civil Aeronautics Board has no intention of tolerating!"

Releases are printed as received from companies and other aeronautical organizations and the responsibility for the accuracy of all statements is therefore not assumed by the Aeronautical Review.

Aeronautical Chamber of Commerce of America

American manufacturers of aeronautical equipment have spent $83,356,580 on plant expansion for national defense, and have let contracts for an additional $232,188,472 worth of facilities which will be in operation by next June. These figures on the aircraft industry's contribution to national defense thus far were reported by Col. John H. Jouett, president of the Aeronautical Chamber of Commerce of America, at the annual meeting of the industry's trade association. He added that the industry has already expanded payrolls from 60,000 shop employees last January to 164,920 at present. When the current expansion programs are completed next June, the industry will have 382,000 shop employees, not including additional thousands taken on by subcontractors, Col. Jouett reported.

National Aeronautic Association

If any doubts have remained as to the value of the Civilian Pilot Training program to the national defense, they are now dispelled by Secretary of Commerce Jesse Jones' statement that more than 2600 of the preliminary and advanced course graduates already are in training with the Army and Navy.

A few months ago, before the program could make its real contribution to preparedness some sharp criticisms appeared. N.A.A. surveyed the situation and found that the C.P.T.P. had not failed but, on the contrary, was just at the point where it could begin to deliver.

Although the program was conceived as a civilian undertaking to stimulate interest in aviation, in line with the promotional responsibilities which the C.A.A. was given by law, the directors of the program were foresighted throughout in gearing the standards of instruction to the needs of air defense in close cooperation with the armed forces. It remained only to make a few adjustments, such as the formal pledging of enrollees to be on call for defense and the expansion of the secondary course which begins to be of practical military use.

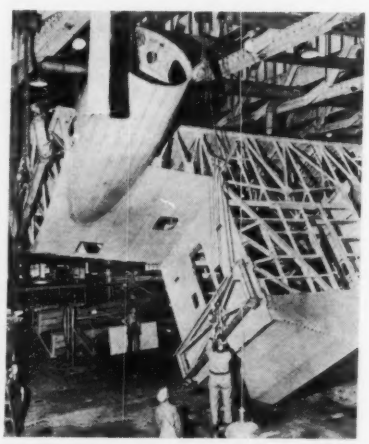
N.A.A. recommended and assisted C.A.A. in working out these changes. They were officially made. Successful in its original aim of creating enthusiasm for flying, intensely and on a wide scale, the program goes on to a higher service of providing hand-picked men of the kind who will make good flyers and who are in aviation because they believe in it.

Air Youth of America

A reading list of books about aviation for young readers has been prepared by Air Youth of America, and published in the November issue of its publication "Air Youth Horizons." Containing over one hundred titles, the list is believed to be the first of its kind that has been published. It has been prepared by Air Youth with the assistance of Dr. Laura Harney who is a specialist in secondary educational materials in aviation.

The list is a graded one, the school levels for which the various books have been found suitable being indicated for most titles.

Free copies of this reading list may be obtained by teachers, group leaders and others who are interested, by writing directly to Air Youth of America, 30 Rockefeller Plaza, New York City.



Built separately and upside down because it's easier to assemble that way, the center-section of one of the giant Boeing Clippers is shown being turned over in the process of moving it into the main hull jig. The structure weighs two tons.

Massachusetts Institute of Technology

Emergency courses to train engineers and technicians urgently needed in the nation's defense industries will be offered soon in a cooperative program sponsored by Harvard University, Massachusetts Institute of Technology, Northeastern University and Tufts College.

The proposed program comprises full-time day courses, as well as evening courses of college grade for men who are employed. Organized to comply with the engineering defense training program of the United States Office of Education, this plan, which has been presented for formal approval, is part of a nation-wide project supported by the government for specialized training in fields essential to national defense. The courses will be offered if there is sufficient demand to satisfy the requirements of the United States Commissioner of Education, and will be given without charge.

The proposed subjects of the evening courses, which will require from two to three hours on two to three days a week for periods ranging from 12 to 20 weeks, include machine design, production engineering and supervision, elementary airplane structures, radio communications, concrete construction and inspection, foremen training, chemistry in national defense, testing and inspection of materials, physical metallurgy, reinforced concrete, and welding engineering. Other evening courses will cover applied mathematics, applications of metallography, exterior ballistics, which is the mathematical treatment of projectiles in flight requiring advanced mathematical preparation; servo-mechanisms, the study of machines which anticipate and control other machines; vibrations and their applications, and instrumentation, which covers the use of engineering instruments employed in design and manufacture.

Boeing Aircraft Company

Scheduled for delivery early next year, the first airplanes of a fleet of six new super-Clippers for Pan American Airways are rapidly being assembled now in the shops of the Boeing Aircraft Company, Seattle.

Designated as Model A-314's, the new Boeing super-Clippers are of the same design with the same dimensions as the earlier flying boats, but incorporate several new advancements, including greater horsepower and greater fuel capacity. The A-314 will have a maximum gross weight of 84,000 pounds (this gross weight was also authorized some time ago for the 314's, which originally used a gross weight of 82,500 pounds). The new Clippers will be equipped with four 1600-hp. Wright Cyclone GR-2600A2A engines and larger propellers, increased 9 inches to a diameter of 14 feet 9 inches. The fuel tanks built into the hydrostabilizers have been increased in size for an additional 1,200 gallons of fuel, or a total of 5,400 gallons, to give the A-314 greater non-stop cruising range.

Consolidated Aircraft Corporation

In a move planned to benefit both the British purchasers and the United States defense program, an announce-

ment from Washington on November 20th disclosed that the first of 26 Consolidated Model 32 4-engine land bombers, which would have become the United States Army's B-24's, are to be delivered to the English. Delivery is expected before March 1, 1941.

These large bombers are similar to the Consolidated prototype Model 32, first flown late in 1939, which marked Consolidated's return to the landplane field. These planes have incorporated in them the latest military features designed to meet the combat requirements learned from the present European conflict. While performance figures are confidential, it is more than likely that these planes equal (and probably exceed) the official statement issued in reference to the prototype which stated, "This airplane, on preliminary examination, gives evidence of living up to the advancements in aerodynamic and performance characteristics predicted. These include a speed of over 300 miles per hour; a range of approximately 3,000 miles; and a bomb-carrying capacity of approximately 4 tons."

These planes are capable of carrying from England a full bomb load to almost any sector in the involved European area and return non-stop, or they can operate by shuttling between England and British bases. Their speed, and defense and attack armament give them adequate protection from all angles. The planes are full cantilever, 4-engine, all-metal, high-wing monoplanes, with high aspect ratio wings and retractable landing gear. Fowler flaps aid this high-speed aircraft in take-offs and landings. Their landing gear is of the tricycle type, with single wheel forward.

Approximate dimensions are: wing span, 110 feet; fuselage length, 64 feet; height, 19 feet. The number of the crew varies with the mission to be performed.

Lockheed Aircraft Corporation

Details of the purchase by the Vega Airplane Company of complete manufacturing rights to the North American Company's NA-35 training plane were announced by Courtlandt S. Gross, Vega president.

Through an agreement signed recently, Vega acquired the prototype airplane, together with engineering design data and drawings. According to Gross, the airplane is already being redesigned, with a view to adapting it to mass production. Although jigs are being built at the present Vega factory, it is planned to move manufacturing operations to the new factory adjoining Union Air Terminal as soon as this is ready for occupancy in January 1941.

The testing tower for parachutes, built by the Pioneer Parachute Company at Manchester, Connecticut, in operation. The whirling dummy which carries the parachute may be spun at controlled speeds up to 300 m.p.h.

Pioneer Parachute Company

For many years, information on the behavior of parachutes was available only through drop tests using a dummy or by live tests, using a parachute jumper, whose experiences in the parachute were not always correctly reported. This method of parachute research was, by its nature, inaccurate, as the limited range of tests possible from an airplane did not cover all service conditions, and did not permit observation at close range. Wind tunnel tests for parachutes have proved impractical.

In order to collect information on the behavior of parachutes at all speeds and at all angles, the Pioneer Parachute Company has built a Test Tower at Manchester, Connecticut, the first structure of its kind ever built. The Test Tower is a mechanism built for the purpose of whirling a dummy around a tower in a circle 200 feet in diameter, at a speed which can be accurately varied from 70 to 300 m.p.h. The horizontal boom is fifty feet above the ground. Attached to the boom are two flexible streamlined rods, which, in turn are connected to the dummy which supports the parachute being tested. On a spreader bar between the cables, a third the distance between the boom and the dummy, a high speed motion picture camera is installed, pointing toward the parachute. When the dummy is whirled to the desired speed, the same light flexible cable which releases the parachute starts the camera. Thus it is possible to get an accurate record of what happened. The tower was designed, engineered and constructed by Provost Smith, Son of Floyd Smith, who is vice-president and chief engineer of the Pioneer Parachute Company.

Republic Aviation Corporation

Specifications and data on the formidable Republic "Lancer," the United States Army Air Corps' P-43 pursuit-interceptor, were released by Republic officials, with the approval of War Department representatives.

No performance figures were given but Republic officers stated the Pratt and Whitney-powered low-wing monoplane, now being supplied in quantity to the Air Corps, had exceeded its top speed guarantees by more than 20 miles per hour during flight tests.

The "Lancer" was designed as a high-altitude fighter with a supercharger installation. This installation gives the plane extreme efficiency as a weapon to combat bombing planes which now seek highest altitudes in order to avoid anti-aircraft gunfire. Peak efficiency of the plane, during tests, was attained at sub-stratosphere altitudes.

The "Lancer" and later types, of which it is the basic design, will be produced by Republic Aviation Corporation in its Farmingdale plant under a $56,500,000 Air Corps contract, the largest single order for pursuit air planes ever placed by the United States Government.

United States Rubber Company

Applying the recent laboratory-discovered knowledge that rubber—ordinarily an insulator—could be made under particular conditions to transmit electricity and throw off heat in the process, U.S. Rubber Company's scientists have developed a self-heating aviator's suit. Submitted to the Air Corps of the United States Army, the

test suit has proved superior to previous types. Proper heat is delivered to the wearer's body with added advantages of less weight and better fit.

A test order for a considerable number of suits has been completed and delivered to the Air Corps. Non-conducting rubber has been turned into a resisting conductor by the addition of certain chemicals during the rubber-mixing process. This new type of rubber sheeting, when electrically connected at the sheet-ends, will pass but resist the current passing through it. The result is a radiant heat thrown off evenly by the entire surface of the sheet.

The degree of heat radiated in any given area can be governed by the area of the radiating piece of rubber-sheeting. Applying this principle, suits, gloves and boots have been made for the use of pilots, gunners, navigators and observers in operations where cold is a problem.

Vought-Sikorsky Aircraft Division United Aircraft Corporation

Speaking before the New England Council in Boston, Igor I. Sikorsky reported that his recent experiments with the Vought-Sikorsky VS-300 helicopter have led him to place a great deal of confidence in the future of this type aircraft.

Mr. Sikorsky, who is Engineering Manager of the Vought-Sikorsky Aircraft Division of United Aircraft Corporation, has made several hundred test flights since last March in the VS-300 helicopter which he designed.

A purely experimental craft, this helicopter has demonstrated its ability to rise vertically and obliquely, to fly forward, backward and sideways, and to hover over one spot under wind conditions ranging from a dead calm to fresh gusts of some 25 miles an hour. In its ability to hover, the machine represents fulfillment of the long-awaited dream of controlled flight at zero miles per hour.

The first public demonstration of the Vought-Sikorsky helicopter occurred on May 20th with Mr. Sikorsky at the controls. The craft thus became the first successful single main lifting rotor helicopter in the world, according to its designer. A few weeks afterward, on July 18th, a flight of more than 15 minutes was made, establishing what is believed to be the longest flight of a direct lift aircraft in the United States.

Several days later an Army Air Corps officer, following only a few minutes of instruction, took the helicopter up on a number of successful flights.

On September 6th and October 14th, the machine was flown for 14 and 15 minutes, respectively, at forward speeds ranging from 0 to 45 miles an hour. Although the fastest speeds have been attained in forward flight, speeds up to 20 miles an hour have been reached in backward and sideways flight. During these and several hundred other flights the helicopter reached altitudes of between 80 and 100 feet.

The photograph on the front cover shows the VS-300 helicopter in flight with its designer at the controls. This picture was released for the exclusive use of the Aeronautical Review by Mr. Sikorsky and the United Aircraft Corp.

On numerous occasions the craft was flown to a landing place hemmed in on all sides by obstacles. Hovering over a small cleared area, it then descended vertically under complete control by the pilot. The helicopter rose into the air with similar ease, clearly demonstrating its ability to operate successfully from areas congested except for a space not much bigger than the diameter of the main rotor—a matter of some 28 feet.

As a result of these experiments it is thought that the helicopter would be highly useful for operations from small spaces between buildings or trees, from a platform on top of a building, from the deck of a ship, or from the limited confines of a back yard.

The most spectacular performance of which the Vought-Sikorsky helicopter is capable is hovering. In an accompanying picture, Mr. Sikorsky is shown hovering the helicopter at a low altitude, while a small suitcase is put aboard. On this flight, one of the many that have been made, the helicopter flew directly up to the man, then hovered before him, and finally backed off with its load without touching the ground during the entire process. The completely satisfactory control of the machine was thus demonstrated.

In earlier single-rotor helicopter types one of the main difficulties was control. This problem of control has been solved in the Vought-Sikorsky VS-300 by an ingenious system of three small auxiliary rotors located at the rear of the fuselage —one being in line with the centerline of the fuselage and revolving in a vertical plane, while the other two are at right angles to the centerline and revolve in a horizontal plane. These elements take the place of the ailerons, elevators, and rudder of the conventional airplane, and the effects of the latter controls are duplicated by merely changing the pitch of the auxiliary rotors.

The main lifting force of the VS-300 helicopter is derived from the main rotor, composed of three blades of 14-foot radius. The magnitude of the lifting force is varied by changing the pitch of the blades of the main rotor.

Thus the main rotor provides the forces necessary for ascent, descent, hovering, or level flight, and the direction of flight is governed by the auxiliary rotors. By using these latter to slightly tilt the helicopter in a certain direction, flight in that direction is achieved.

A 90-horsepower aircooled engine, located near the center of gravity of the helicopter, supplies the power to drive the rotors. Most of this power is transmitted to the main rotor by belts, while the auxiliary rotors receive a small amount via a drive shaft and belts. The auxiliary rotors each have a diameter of $7\frac{1}{2}$ feet, are lightly loaded and rotate approximately four times as fast as the main rotor.

The Vought-Sikorsky helicopter has three necessary flight controls: the control column or stick, the foot pedals and the main pitch control lever. There is considerable advantage in this arrangement because it calls for none other than normal airplane flight reactions on the part of the pilot.

For example, moving the control column from side to side differentially changes the pitch of the two horizontal auxiliary rotors, causing a lateral reaction similar to that produced by the ailerons of a conventional airplane. By moving the control column forward and backward, the pitch of the horizontal auxiliary rotors is changed to bring about a longitudinal action similar to that of elevators. Rudder action is achieved through the foot pedals, which vary the pitch of the vertical auxiliary rotor. This rotor serves two purposes, that of changing the direction of flight and of counteracting the torque of the main lifting rotor.

The controls for the main lifting rotor and the horizontal auxiliary rotors are synchronized with the engine throttle.

A great advantage of the control system employed in the VS-300 helicopter —compared with that of the conventional fixed-wing airplane—is that the feel and effectiveness of the controls never vary, regardless of the attitude of the machine, since the control surfaces are always rotating at rates far in excess of their stalling speeds.

The lift and control system of the Vought-Sikorsky helicopter has the added advantage of simplicity, and it is believed that this offers possibilities of inexpensive production and easy maintenance.

In fact, the helicopter in the form of the VS-300 presents no unusual manufacturing difficulties, even from the standpoint of mass production, according to Mr. Sikorsky.

News Review

November 14. Brig. Gen. John F. Curry, Commander of the Tenth Pursuit Wing, was ordered to command the Northwest Air District at Spokane, Washington.

November 14. The Lockheed Aircraft Corporation purchased the Union Air Terminal at Burbank, California, from United Air Lines.

November 14. A type of American bomb sight will be released for use by Great Britain.

November 15. Air Marshal William A. Bishop of Canada told the National Geographic Society in Washington, D. C., that the Empire Training Program now under way in Canada was a year ahead of schedule.

November 15. Workers in the Vultee Aircraft Co.'s plant went out on strike in a wage dispute, stopping British and U.S. aircraft orders.

November 15. The Collier Trophy for achievement in aviation was awarded to the air lines of the United States in recognition for their safety record during 1939. Special mention was also made of Dr. Walter M. Boothby and Dr. W. Randolph Lovelace, 2nd, of the Mayo Clinic and to Captain Harry G. Armstrong of the physiological laboratory at Wright Field, for their research in pilot fatigue and the physical effects of high altitude flying.

Acme Newspicture

President Roosevelt presenting the annual award of the Collier Trophy to the airlines of the nation for their high record of safety in air travel. Special recognition was also given the three physicians, shown above with the President, for their research in the effects of high altitude flying. They are (l. to r.), Dr. Walter M. Boothby and William R. Lovelace II of the Mayo Foundation and Captain Harry C. Armstrong of the Army Medical Corps.

November 15. The C.A.B. approved the plans for the training of 4,000 Canadian pilots in U.S. flying schools, according to a statement made by Clyde Pangborn, R.C.A.F. liaison officer.

November 15. The National Defense Commission announced plans for a $21,000,000 plant in Detroit, where airplanes will be assembled from parts built by automobile manufacturers.

November 16. Pan American Airways applied to the C.A.B. for permission to extend their transpacific air mail service from Manila to Singapore.

November 16. The Navy Department awarded a $29,139,793 contract to the Curtiss-Wright Corp. for 793 airplanes. The new SB2C-1 dive-bomber was among the craft ordered.

November 17. The Seaboard Airways, a subsidiary of the Seaboard Railroad, applied to the C.A.B. for permission to operate an air line between Boston, Miami and New Orleans.

November 17. Great Britain may get up to fifty percent of the output of U.S. aircraft factories, according to the authorization of President Roosevelt.

November 18. Douglas Aircraft Company began work on a new factory which may be made invisible from the air at night.

November 19. The Allison Engine Division of General Motors Corp. has increased production to 286 engines a month, according to an announcement made by C. E. Wilson, acting president of the General Motors Corp.

November 20. Canada's Air Minister, C. G. Power, announced the creation of two departments in the Air Ministry, in a reorganization designed to decentralize the Empire Training Program in Canada. Commodore Robert Leckie will be in charge of the new department for training, while Captain S. G. Tackaberry will head the newly formed department of supply. Commodore G. O. Johnson became Deputy Chief of Staff.

November 20. The Wright Aeronautical Corporation announced a salary increase of seven percent for all employees who have been with the company six months or longer.

November 20. President Roosevelt proclaimed December 17th as Pan-American Aviation Day.

November 20. The Curtiss-Wright Corporation began the construction of a $11,000,000 factory building at St. Louis, Missouri.

November 21. The U.S. Government began action to turn twenty-six

four-engined bombing airplanes, Boeing B24s and Consolidated B17-As, back to their manufacturers for resale to Great Britain.

November 21. Captain Charles E. Rosendahl, U.S.N., is heading a survey commission, to locate a dirigible base in the Boston area.

November 21. U.S. State Department officials decided to take no official cognizance of the legal question concerning American pilots flying in the Eagle Squadron in England.

November 21. The original Wright Airplane, stored at the South Kensington Museum in London, was removed to a cellar below the building to protect it from damage during air raids.

November 22. The withdrawal of the American Export Steamship Lines from mail service left Pan American Airways as the only link between Portugal and North America for mail delivery.

November 24. The U.S. Navy ordered 2100 long range flying boats from Glenn L. Martin and Consolidated. One thousand of these will be Consolidated PBYs, while the Martin company will supply 1100 twin-engined PBMs.

November 24. The Priorities Board of the National Defense Commission asked manufacturers building military aircraft to concentrate their efforts on airplanes for National Defense. Some manufacturers protested, on the grounds that the commercial orders for aircraft do not retard the Army's deliveries, and that the civilian trade must be retained after the National emergency.

November 24. Glen L. Martin will receive the Daniel Guggenheim Medal at the Honors Night dinner of the Institute of the Aeronautical Sciences, for his contributions to aeronautical development, and for the production of high performance aircraft.

November 24. The Civil Aeronautics Board authorized the Boston and Maine Airways to inaugurate a new route between Bangor, Maine, and Moncton, New Brunswick.

November 24. The air-line service between Berlin and Madrid was extended to serve Lisbon.

November 25. The U.S. Navy will permit Great Britain to take first deliveries on new Consolidated PBY-5 long range patrol seaplanes.

November 26. The Japanese opened an air line between the Caroline Islands and Formosa. This line crosses Pan American Airways transpacific route between Guam and the Philippines.

November 26. Cleveland Municipal Airport was selected as the site of the N.A.C.A.'s $8,400,000 engine research plant.

November 27. Strike at the Vultee plant was settled. Workers got a wage increase, and were committed to no-walkout contract for sixteen months.

November 27. Automobile manufacturers organized a committee to make the automotive industry's facilities more easily available for air defense manufacturing.

November 28. The Chamber of Deputies of Uruguay ratified the plan proposed by the United States for the construction of naval and air bases in Uruguay, for the joint defense of the hemisphere.

November 29. The Curtiss-Wright Corporation began construction of an $11,000,000 aircraft and engine plant at Columbus, Ohio. The new plant will employ 12,000 persons.

November 30. The Royal Canadian Air Force took over the 144 combat airplanes ordered by Sweden from the Vultee Aircraft Corporation. This is the second group of airplanes ordered by Sweden to be diverted.

December 1. The congestion of airplanes waiting for landing clearance over the air-line terminal airports at New York and Chicago was criticized in a report by Captain H. Little to the Air Line Pilots Association's Annual Convention in Chicago. The report stated that both New York and Chicago could use two or three more airports for the exclusive use of the air lines.

December 1. C. C. Carlton, vice-president of the Motor Wheel Corporation, was appointed permanent chairman of the Automotive Committee for Air Defense. This group will study how the automobile manufacturers can best fit their production facilities into the aviation phase of the rearmament program.

December 3. The Goodyear Zeppelin Corporation consulted the Brazilian Government on the possible establishment of a dirigible line between Miami and Rio de Janeiro.

December 3. The Priorities Board of the National Defense Commission announced that an exception would be made in the ruling to hold commercial air transport construction to a minimum in the case of Pan American Airways. The importance of Latin-American transportation was held to be the reason.

December 3. The Air Transport Association announced that the air lines will delay proposed expansions, and release recently delivered engines to aid the rearmament program.

December 3. Official sources in Milan, Italy, announced the testing of a radical type of airplane, which they claim will revolutionize high altitude fighting. The airplane takes off using a conventional engine and propeller. At high altitude, where the propeller becomes less efficient, the airplane uses jet propulsion.

December 5. The War Department announced that Brig. General John B. Brooks and Brig. General Carlyle H. Walsh had been ordered to take command of the 4th and 5th Bombardment Wings, respectively. Headquarters for the Fourth Bombardment Wing are at Westover Field, Chicopee Falls, Massachusetts. The Fifth Bombardment Wing headquarters are at Spokane, Washington.

December 5. Members of the Civil Aeronautics Board, the Authority of the Port of New York, the Regional Planning Board and the New Jersey State Aviation Commission met to discuss the construction of an 1100-acre airport at Caven Point, New Jersey, a peninsula in New York's Upper Bay.

December 5. The Seventeenth Pursuit Squadron, formerly at Selfridge Field, Michigan, arrived in Manila, P. I. This transfer was a move to strengthen the U.S. position in the Far East.

December 6. Col. John H. Jouett, President of the Aeronautical Chamber of Commerce, in his report to the annual meeting of the Chamber, stated that the amount of floor space devoted to the production of aircraft had doubled in the last twelve months. By next June, Col. Jouett predicted that the industry would employ about half a million workers.

December 6. The Curtiss Aeroplane Division of the Curtiss-Wright Corporation announced a seven percent wage increase for all of its employees.

December 7. Leonard W. Brockington, Counsellor to the war committee of the Canadian Cabinet, told the annual convention of Life Insurance Company Presidents, meeting in New York, that 10,000 U.S. citizens had volunteered for the Royal Canadian Air Force.

December 7. The National Defense Commission and the War Department approved the sites for assembly plants at Kansas City and Omaha for twin-engined bombers. These airplanes will be built of parts fabricated in automobile plants. Two other plants at unannounced sites will assemble four-engine bombers.

December 8. The Mexican Government granted American Airlines permission to extend their Dallas-Fort Worth route to Mexico City.

STEEL

A bibliography giving references for research in this specialized field. Revised and brought up-to-date from the fifty volume Bibliography of Aeronautics compiled and published with the cooperation of the Work Projects Administration from the Aeronautical Index of the I.Ae.S. In this Bibliography the references have been classified and cross-indexed under four main headings.

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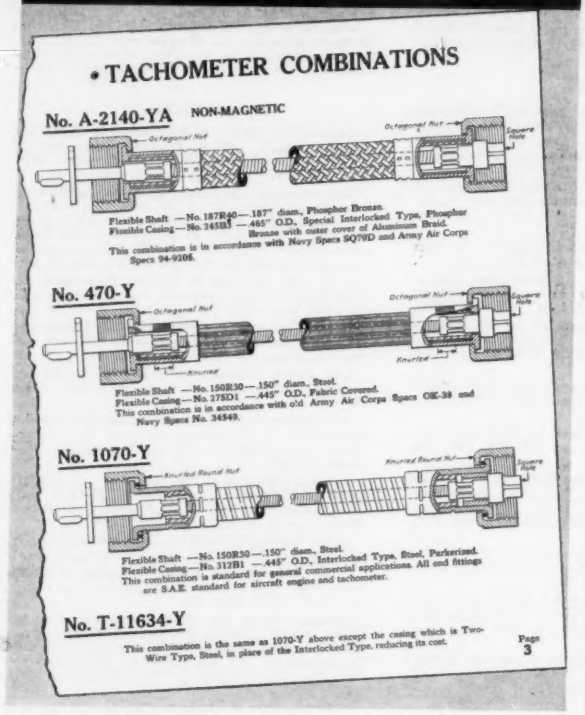
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Octagonal Nut
Square Hole
Knurled
Knurled
Flexible Shaft —No. 150R30—.150" diam., Steel.
Flexible Casing—No. 275D1 —.445" O.D., Fabric Covered.
This combination is in accordance with old Army Air Corps Specs 0K-38 and Navy Specs No. 34349.
No. 1070-Y
Knurled Round Nut
Knurled Round Nut
Square Hole
Flexible Shaft —No. 150R50—.150" diam., Steel.
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British Demand Reprisals

Reprisals—Should We Bomb Germany Indiscriminately? Sidney Horniblow. With many people in Britain demanding indiscriminate bombing in reprisal for German bombing of British civilian areas, arguments for and against such action are presented, and readers are asked for their opinions. *London Calling*, November 9th.

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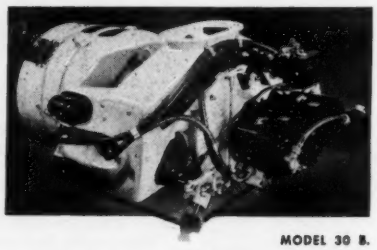

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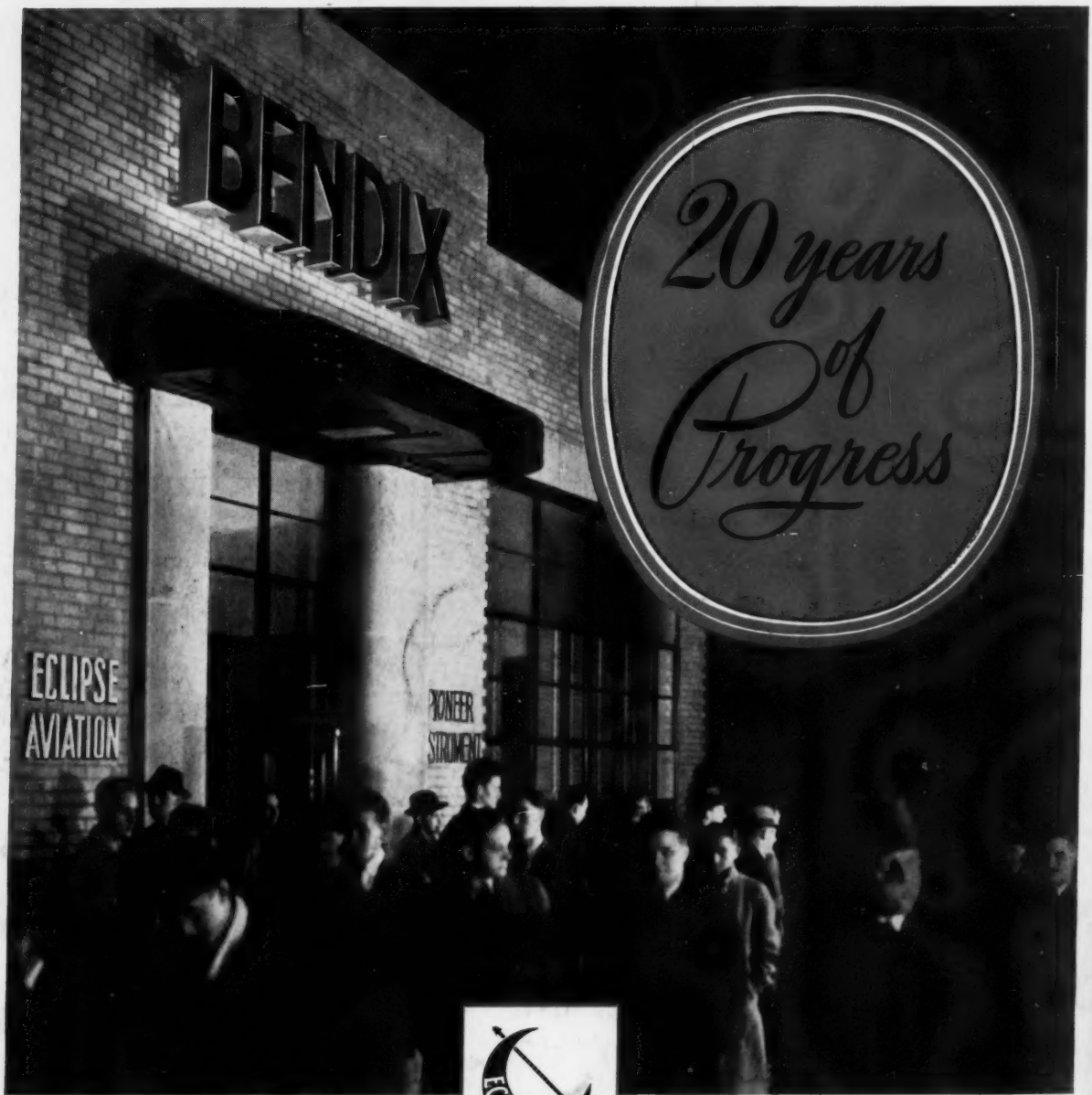

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